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INTUITION, REASON AND FAITH IN SCIENCE¹

By Professor GEORGE D. BIRKHOFF

HARVARD UNIVERSITY

FROM the earliest times scientific ideas even when crudely conceived have been of immeasurable importance, not only for man's material advancement and control over nature, but also in modifying and expanding his philosophic and religious outlook. In the effort to obtain a better understanding of his place in the cosmos, he is compelled to proceed largely by considerations of analogy based upon supposed or actual fact. And so he turns more and more toward the ever-widening vistas suggested by science in its continual discoveries of new truth.

To-day the significance of science as a principal source of revelation is almost universally recognized. Thus recently, on behalf of Pope Pius XI, Cardinal Pacelli spoke before the Pontifical Academy of Sciences concerning the enlightenment that comes from

"the potent streams of the natural and rational sciences and the great river of revealed wisdom."² He said that the former are found "wherever man looks for and finds truth." As for "the great river of revealed wisdom," is it not to be found in all the absolutely sincere utterances of poets, philosophers and prophets, based on the relevant knowledge of their day and made after deepest meditation? It would seem that such utterances are in essence similar to the pronouncements of the scientist. Is not the vague, prophetic conjecture of Pythagoras that nature is mathematical as true as Newton's more precise law of gravitation? From this point of view, the great streams of revelation seem to merge insensibly into one.

Nevertheless, the immediate effect of scientific advances is often very disquieting. The strong opposition long shown to the Darwinian theory of evolution

¹ Address of the president of the American Association for the Advancement of Science, Richmond, Va., December 27, 1938.

² See SCIENCE, 86: 2238, 470-472, November 19, 1937.

bears witness to this fact. Similarly at the present day the ever-increasing number of uncoordinated theories and mechanical inventions confuses and chills many of us. Man is felt to be a mere tragic detail in a vast incomprehensible whole, and our old sense of values seems to become less and less real.

To persist in such an attitude of discouragement is unjustified. Every individual has implanted within him the desire to understand his rôle in the existing order. He feels an inalienable right to find out his duties and privileges as a citizen of the universe. By the light of any new knowledge he is always certain to gain deeper insight into his position. The wise advice of our own great Emerson comes to mind: "Fear not the new generalization. Does the fact look crass and material, threatening to degrade thy theory of spirit? Resist it not: it goes to refine and raise thy theory of matter just as much."

What, then, are some of the larger points of view which are suggested by science to-day? In attempting a reply I can of course only offer a personal interpretation, inevitably reflecting the fact that I speak as a mathematician having some acquaintance with physics.

Let us observe in the first place that the universe presents antipodal aspects—the objective and the subjective, the impersonal and the personal. If we take the objective aspect as more fundamental we put our emphasis on the notion of reality; and if we start from the subjective, we prefer to speak of knowledge. In either case we are able to discern a kind of nature-mind spectrum; for there appears a roughly given hierarchy of five ascending levels—mathematical, physical, biological, psychological and social. Each level has its appropriate special language. The basic corresponding concepts are respectively: *number* at the mathematical level; *matter* at the physical level; *organism* at the biological level; *mind* at the psychological level; and *society* at the social level. If we choose to select one of these as somehow more real than the others, a great distortion arises in our point of view. For instance, if we regard the physical level as the most fundamental, we become materialists. But why make such an unnecessary choice? The languages of the various levels are essentially independent of one another, and the observed laws are best expressed in their own natural terms. Why mix up the levels of knowledge unnaturally? Does it clarify our idea of social justice to try to explain it in terms of the reactions between protons and electrons in the brain?

These considerations bring us to a first general point of view towards the levels of knowledge: It is desirable to accord reality in equal measure to all kinds of knowledge everywhere, and so to view the universe as broadly and impartially as possible.

Another very important observation is that in order

to understand the various facts and their interrelations we must always use abstractions, that is, conceptual tools of a logical or mathematical nature. Contrary to opinions which prevailed until recently, any abstraction serves only limited specific ends. At best it will enable us to grasp more clearly some small fragment of reality. For example, by use of the abstraction of Euclidian geometry, and in that way alone, we understand the nature of space with a considerable degree of exactitude; and yet to-day scarcely any physicist would ascribe objective reality to space in itself. It has been Einstein more than any one else who has taught the scientific world the true rôle of Euclidian geometry by means of his theories of space-time and relativity. More generally, we have come to realize that our only approach to a better understanding of the world is by means of a widening succession of abstract ideas, each explaining imperfectly some aspect of the stupendous whole. This is a second synthesis deserving of especial emphasis.

Thirdly, I would state a fundamental truth about the social level, which in some sense is the highest level of all: The transcendent importance of love and good-will in all human relationships is shown by their mighty beneficent effect upon the individual and upon society.

Thus I have begun by presenting very briefly three important articles of my personal faith. These are not verifiable experimentally or strictly demonstrable, so that any one is free to agree or to disagree. Against my belief that the levels of knowledge are to be taken as equally real, one may set for instance an opposing belief that every fact is ultimately expressible in purely physical terms. If my position is natural for the mathematician with his abstract point of view, the other may be preferred by the tough-minded physicist, the biologist with mechanistic inclinations and the psychologist with a behavioristic outlook. The future will probably show that both of these beliefs are partly true and partly false.

Similarly, against my conviction that any particular abstraction is merely a useful tool enabling us to understand certain facts, some will contend that one particular abstraction will prove to be final and absolute. Here my attitude springs from an extensive acquaintance with mathematical abstractions and their numerous applications, whereas the theoretical physicist, for example, tends to believe that the ultimate theory of atomic structure is soon to be obtained.

Likewise some will declare that, much more than love and good-will, it is devoted loyalty to the state which is important; and I can imagine that under certain conditions such an assertion might be justified.

It is my especial purpose to show how this phenomenon of faith arises inevitably in the mind of the

scientist whenever he tries to evaluate technical conclusions in his special field. In doing so I shall discuss the role of intuition, reason and faith in science, first at the mathematical and physical levels, and then more briefly at the biological, psychological and social levels. This will lead me in conclusion to formulate two other items of my personal creed in the hope that they may be worthy of your attention.

By way of definition it must be indicated first what is meant by intuition. There are certain elementary notions and concepts which come spontaneously to the minds of all who observe, experiment with and reflect on a specified range of phenomena. Such generally accepted ideas or intuitions constitute the consensus of reaction of intelligent men to a definite part of the world of fact. John Stuart Mill has said, "The truths known by intuition are the original premises from which all others are inferred." It is in this sense that I shall refer to intuition. By reason I shall mean the rational superstructures which may be erected upon the basic intuitive ideas by means of deductive or inductive reasoning. These superstructures will also be accepted by all who are able to follow the sequence of logical steps involved. By faith I shall mean those heuristically valuable, more general points of view, which are beyond reason, and sometimes in apparent contradiction with one another, but which to the individual concerned seem of supreme importance as he endeavors to give his conclusions the widest possible scope.

It is clear that in this way we obtain a basic classification of knowledge into three easily distinguishable types. Let us consider the occurrence of these types at the various levels of knowledge.

By continual crude experimentation with classes of concrete objects, man has come gradually and inevitably into the possession of certain numerical ideas. In particular he has been led to think of the positive integral numbers 1, 2, 3 . . . as entities which exist in almost the same sense as the objects themselves. This concept finds its realization in the designation of the integers by corresponding marks 1, 2, 3 . . . Such integers are found to be subject to certain simple arithmetic laws, and these laws are regarded as intuitively true.

The integers form the basis of a great part of mathematics. For it is found that with their aid one may construct fractions and, more generally, real and imaginary numbers. In the course of the centuries mathematicians have thus built by processes of pure reason the elaborate structures of algebra, the theory of numbers and analysis. An extensive array of beautiful and useful theorems has been deduced.

Similarly in geometry—which in its origin may be regarded as the most elementary branch of physics—

we experiment with rigid material objects and arrive readily at the notions of idealized small rigid bodies or "points" and of idealized "lines" and "planes." Then we observe that certain postulates hold, such as the familiar ones of Euclid. By means of these postulates, which embody our intuitions, we are able by deductive reasoning to arrive at other geometrical theorems, including such results as the celebrated Pythagorean theorem which shows us in particular that a right triangle with legs of 3 units and 4 units in length has a hypotenuse of exactly 5 units in length. The vast mathematical domain called "geometry" has arisen from these elementary geometrical facts as a primary source.

There are many other abstract mathematical structures besides those just alluded to. In all cases it is found that they are made up of certain accepted intuitions (or postulates) and their logical consequences.

Now what I desire particularly to point out is that the mathematician goes far beyond such generally accepted clean-cut assumptions and conclusions, in that he holds certain tacit beliefs and attitudes which scarcely ever find their way into the printed page. Yet these form none the less part of a considerable oral tradition. For instance, he believes in the existence of various infinite classes such as that made up of all the integers. He believes also that the whole body of strict logical thought called mathematics is self-consistent: in particular when he finds that the number π admits of diverse forms of expression, as, for example,

$$\pi = 4 \left[1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots \right]$$

and

$$\pi = 2\sqrt{3} \left(\frac{1}{2} - \frac{1}{6} + \frac{1}{18} - \frac{1}{54} + \dots \right)$$

he feels absolutely certain that if the unending calculations could be fully carried out, the results would be exactly the same in all cases. Furthermore, when he recalls that in the past the most difficult mathematical questions have been ultimately answered, he is inclined to believe with the great German mathematician, Hilbert, that every mathematical fact is provable. Besides all this, he attributes certain values to his results and their mathematical demonstrations: some theories seem important; some proofs are regarded as elegant, others as profound or original, etc.

Such somewhat vague ideas illustrate what I would call mathematical faith. Nearly all the greatest mathematicians have been led to take points of view falling in this broad category, and have attached the deepest significance to them.

What I wish to emphasize concerning this generally overlooked aspect of mathematical thought is that, on the one hand, the beliefs involved have been of the

utmost heuristic importance as instruments of discovery, and, on the other hand, when examined in detail they generally turn out to involve ideas which are held true or false, according to the specific definitions which may be subsequently adopted.

Suppose, for instance, that we turn to the first question of the existence of infinite classes. There was no hesitation about the unconditional acceptance of such classes until within a few decades, although a few, like the ancient Greek philosopher Zeno and the German algebraist Kronecker, profoundly distrusted the use of the infinite in mathematical reasoning. To-day, however, due primarily to the theory of transfinite aggregates created by Georg Cantor about fifty years ago, mathematicians have come to realize that such an infinite class may exist in the so-called "idealistic" sense but not in the sense of explicit constructibility. Thus the class of all collections of positive numbers less than 1 exists in the idealistic sense, but not in the alternative, more concrete sense.

A similar situation has arisen in the detailed study of the self-consistency of mathematics. It has appeared that very limited parts of mathematics can be proved self-consistent. But such a general assertion as that "the whole of mathematics is self-consistent" would be considered to-day not to be sufficiently precise; and each time that the proof of self-consistency is extended further, a definite logical price has to be paid in that certain so-called metamathematical ideas are tacitly employed, which need themselves to be investigated in the same respect. For instance, work prior to the "Principia Mathematica" by Whitehead and Russell (1910) showed that if the notion of class was not restricted, certain logical paradoxes would inevitably result. For this reason a theory of the "hierarchy of types" was devised by them, which limited the notion of class and so avoided the apparent inconsistencies. We are thus entitled either to say that mathematics as of the year 1900 was self-consistent or was not, according to the point of view which is adopted. In any case the belief in question has led us to a much deeper insight into the nature of logic.

With regard to the unlimited power of mathematical demonstration, it has been recently proved by the Austrian mathematician Gödel that, if we restrict ourselves to reasoning of an ordinary type, there exist explicit "undecidable" theorems, while from a higher metamathematical point of view such a theorem might be demonstrable. Hence Hilbert's affirmation is in one sense false. But despite this fact the open question on which he focused attention is much better understood than ever before.

Likewise in the question of value in mathematics, such as the importance of theories, or the elegance,

profundity and originality of proofs, it is clear that these obscure ideas depend in large measure upon the momentary state of the science. Thus the theory of functions of an imaginary variable and classical geometry were regarded as extremely important a quarter of a century ago; while to-day the theory of functions of real variables and the basic kind of geometry called analysis situs have respectively displaced these subjects in general mathematical esteem. It would be hard to explain adequately the reasons for this change, but the increasing role of discontinuous quantity in physical theory and the relativistic point of view towards space and time have certainly been contributing factors.

An excellent instance of the power of individual mathematical faith in bringing about creative advance has been afforded by an American mathematician, the late Eliakim Hastings Moore, past president of this Association. Moore was a thorough-going abstractionist who believed that mathematics itself should be reorganized from a still higher point of view, by the dissection of essential common parts out of apparently different abstract fields. His point of view was strongly confirmed by the analytic work of Hilbert and Erhardt Schmidt near the beginning of this century. And so Moore was led to create his "General Analysis" in 1906. This aimed to embody his conviction that "The existence of analogies between the central features of various theories implies the existence of a general theory which underlies the particular theories, and unifies them with respect to these central features."

As time has elapsed, the deep truth of Moore's contention has been amply sustained. Indeed one of the most active schools of contemporaneous mathematical thought follows the higher abstract point of view adopted by Moore. But it has been found necessary to modify Moore's program, in that, instead of a single "General Analysis" serving as an *omnium gatherum*, it has been desirable to employ a few typical forms. In this way his faith in the power of higher abstraction has been largely and yet not fully justified.

A good many mathematicians are seriously hampered by lack of the ardent positive faith which Moore showed. This type of deficiency is generally due to a strong development of purely critical powers and to over-specialization. Several times I have observed this lack in myself, only to be counteracted by definite effort. For example, I did not make active use of the fundamental integral of Lebesgue for a long time, and so was prevented from pursuing to their natural conclusion certain ideas which finally led me to establish the basic "ergodic theorem" in 1931. Here I was finally converted, as it were, to the use of this tool by the important advances of Koopman and von Neu-

mann, and in particular by the latter's proof of the "mean ergodic theorem." It is worthy of note that the related ergodic hypothesis goes back in its origins to the physicists Boltzmann and Maxwell.

Let us turn next to the physical level where the corresponding situation is at least equally interesting.

If we accept the ordinary conceptions of space and time, which seem destined always to play a basic role in workaday physics, we find that the simplest physical ideas are those which arise through the manipulation of massive bodies. As these ideas have become clarified, they have been given abstract formulation in terms of such concepts as those of mass, force, etc. Newton's celebrated three fundamental laws of motion embody the final form of the refined intuitions thus arrived at. With these as a basis and the acceptance of certain further special observed laws, one may deduce by mathematical reasoning the theory of mechanics as applied, for example, in the solar system.

Similarly, through experimentation with electrified bodies, electric currents, magnets, etc., there was developed by Faraday the intuitive ideas of electric and magnetic lines of force which are now generally accepted. Later Maxwell incorporated these ideas in the appropriate electro-magnetic equations. Upon this basis all classical electro-magnetic theory has been logically constructed. Furthermore, by means of the identification of the light wave and the electro-magnetic wave, due to Maxwell, an adequate theory of light has been obtained.

Thus we see the important role which intuition and reason have played in two fundamental branches of physics—mechanics and electro-magnetism. A cursory survey of the various other branches of the subject would show that a similar situation holds throughout, except in the rapid developments of quantum mechanics during the last decade or so. In this strange theory the physicist begins indeed with a planetary model of the atom, reminiscent of Niels Bohr's earlier theory. But a flying leap is made from this temporary scaffolding to what is thenceforth regarded as the only basic reality—the wave equations of Schrödinger and, better still, of Dirac. Once having arrived at these mathematical equations the physical theorist proceeds to show how he can predict innumerable facts previously out of his range by use of this arbitrary *ad hoc* machinery. The process involved somehow reminds me of a record sea voyage made through a fog! I can not but anticipate that a more intuitive and natural approach to essentially the same results will be found later on. An analogous earlier instance in physics is perhaps to be found in the unmotivated theory of cycles and epicycles entertained by the ancient astronomers. This explained the motions of the heavenly bodies with considerable success, but was

destined to be completely displaced by the intuitively reasonable, gravitational theory of Newton.

The fact remains, however, that the recent development of quantum mechanics forms one of the most astounding and important chapters of all theoretical physics.

It is interesting to recall how this great advance came about through the faith of the German physicist Planck at the outset of the present century. His direct experience with the phenomena of radiation had led him to believe that there were discontinuous processes at work, not to be explained by any modification of the time-worn classical theories, and so he was led to formulate his celebrated quantum hypothesis in 1900. It was this daring concept of Planck, more than anything else, that has freed the minds of physicists from the shackles of too conventional thinking about atomic phenomena, and so has made possible the quantum-mechanical quest of which the end is not yet in sight.

There has always been an abundance of faith among the physicists. Every one knows how Newton and others have found confirmation even for their religious beliefs in the lawful character of physical phenomena. It is not hard to understand why the tendency towards dogmatic affirmation among the physicists has been stronger than among the mathematicians. For the physicist with considerable justice feels that he is exploring the mysteries of the only actual and very exciting universe; whereas the mathematician often appears to live in a purely mental world of his own artificial construction. A good illustration of this tendency of the physicists is afforded by their changing attitudes towards the wave theory versus the corpuscular theory of light. Over a considerable period the corpuscular theory of Newton held sway; then this was displaced by the wave theory of Huyghens, the Dutch physicist; and nowadays a kind of vague, uncertain union of the two is generally accepted.

In this connection it is especially interesting to recall the scientific beliefs to which Faraday was led in his fundamental work on electricity and magnetism. From his experimental results in this field, he saw that there was obeyed here as elsewhere the law which he called the "conservation of force" and which we today would call the "conservation of energy." He saw that this energy was localized in space, and he could only conceive of it as being propagated in time; and so he was led to the belief that electro-magnetic energy is also propagated with finite velocity. Thus in an article, "On the Conservation of Force," published in 1857, he expressed himself as follows: "The progress of the strict science of modern times has tended more and more to produce the conviction that 'force [energy] can neither be created or destroyed' . . . ;"

"time is growing up daily into importance as an element in the exercise of force; to inquire, therefore, whether power acting either at sensible or insensible distances, always acts in *time* is not to be metaphysical." By way of justification of the rather mathematical direction in these thoughts, Faraday said further, "I do not perceive that a mathematical mind, simply as such, has any advantage over an equally acute mind not mathematical . . .;" "it could not of itself discover dynamical electricity nor electromagnetism nor even magneto-electricity, or even suggest them." But the achievements of the more mathematical Maxwell were later to show that Faraday had underestimated the power of pure reason.

It is thus clear that through an act of faith Faraday attained to a kind of deeper insight; for the existence of the electro-magnetic wave has long since been established experimentally. However, the beliefs of Faraday in this connection can not be regarded as absolutely true, since according to present-day conceptions the notion of energy which he accepted is only roughly valid as a statistical approximation. Nevertheless, Faraday certainly penetrated more into the nature of electrical and magnetic phenomena than any of his contemporaries; and it is difficult to see how, with the limited mathematical and physical knowledge at his disposal, he could have gone any further in the way of prophetic conjecture.

The intimate relation between philosophical-scientific points of view and actual advances in theoretical physics has been admirably illustrated by Einstein's gravitational theory of 1915. Taking as his starting point the bold but reasonable hypotheses that matter must condition space and time, and that, in parts of space remote from matter, elementary particles move with uniform velocity in a straight line, he arrived at his field equations as the most elegant mathematical embodiment of these ideas. Thus there was obtained a quasi-geometrical theory of gravitation which in certain respects is more natural than the celebrated theory of Newton, while the predicted differences, although excessively minute, are in favor of the new theory. But Einstein's theory can not be regarded as true in any absolute sense, since it gives us at best a partial, highly idealized view of the physical universe.

It is hardly too much to say that, since the beginning of the present century, the main advances in theoretical physics have been the outcome of a similar kind of mathematical guesswork, in which, however, the mathematician himself has taken little or no part! The guessing of the physical theorist is guided almost entirely by considerations of subtle mathematical analogy.

This peculiar situation has led naturally enough to the feeling that pure mathematics almost suffices with-

out much recourse to the results obtained in the physical laboratory. Sir Arthur Eddington has embodied the extreme point of view in his recent book, "The Relativity Theory of Protons and Electrons," thus taking a position antipodal to that of Faraday. Eddington says: "Unless the structure of the nucleus has a surprise in store for us, the conclusion seems plain—there is nothing in the whole system of laws of physics that can not be deduced unambiguously from epistemological considerations. An intelligence, unacquainted with our universe but acquainted with the system of thought by which the human mind interprets to itself the content of its sensory experience, should be able to attain all the knowledge of physics that we have attained by experiment. . . . For example, he would infer the existence and properties of radium, but not the dimensions of the earth."

I would comment upon this mystical conjecture of Eddington as follows: It is no doubt partially true that in some respects we need the laboratory less than we did before, due to the fact that we live surrounded by all manner of scientific instruments and machines, with whose properties we have become acquainted. In other words, we live in a transformed world which is a kind of huge laboratory. Yet I doubt whether any individual, however intelligent, who was not acquainted with such instruments and machines, would be able, through analysis of ordinary sensory experience, to go very far. On the other hand, I would agree with Eddington that the starting point from which known physical laws may be deduced is likely to depend on only a few intuitive ideas; and perhaps a sufficiently powerful mathematical intelligence would realize that the facts of sensory experience could only be simply explained in this way.

An equally remarkable conjecture was expressed by Dr. Charles Darwin in a vice-presidential address, "Logic and Probability in Physics," before the British Association last summer. In this address he said, "The new physics has definitely shown that nature has no sharp edges, and if there is a slight fuzziness inherent in absolutely all the facts of the world, then we must be wrong if we attempt to draw a picture in hard outline. In the old days it looked as if the world had hard outlines, and the old logic was the appropriate machinery for its discussion." He therefore suggested "that some day a real synthesis of logic will be made" leading to "a new reformed principle of reasoning."

Here I can agree with Darwin to the extent of admitting that there always exists a metamathematical fringe in logic. But it seems obvious that in logic there has been a record of continual advance by critical and profound diversification rather than by any essential alteration of point of view.

In my own limited experience in mathematical

physics I have also seen how natural it is to take a positive attitude on open questions. Thus a good many years ago I showed mathematically that mere spatial symmetry about a center necessitates a static gravitational field. This led me to believe that the Einstein field equations were probably too inelastic to fit the facts, but I did not put forth this opinion. Shortly afterwards Lemaitre, in trying to explain the expanding (non-static) stellar universe found it necessary to modify the field equations, in part because of my result; and so my belief was to this extent justified.

Again, I have had during the last few years a feeling that a conceptual space-time model for quantum mechanics is likely to be found, although theoretical physicists would in general disagree. Nevertheless, my faith is so strong that my recent researches lie principally in this direction. I have already found interesting results, and am confident that these efforts will not be wasted, since the possibilities of the conceptual approach need to be more carefully explored.

In ending these remarks about the role of intuition, reason, and particularly of faith, at the physical level, it is to be observed that the physicist as such systematically ignores the phenomena of life, for it is dead and not living matter with which he concerns himself in his laboratory.

All in all, it is a faith in the uniformity of nature which remains the guiding star of the physicist just as for the mathematician it is a faith in the self-consistency of all mathematical abstractions, although these faiths are more sophisticated than ever before. The minds of both are tinged with an unwavering belief in the supreme importance of their own fields. The mathematician affirms with Descartes, *omnia apud me mathematica fiunt*—with me everything turns into mathematics; by this he means that all permanent forms of thought are mathematical. The physicist on his part is apt to think that there is no reality essentially other than physical reality, so that life itself is finally to be fully described in physical terms.

Although I have no especial acquaintance with the biological, psychological or social domains, it seems clear to me that a similar situation prevails in them. In the biological field the intuitions upon which one depends are those associated with the concept of the organism and its evolution. These intuitions can not be formulated conclusively and completely in simple postulates, as is possible at the mathematical and physical levels. It is rather through an acquaintance with an immense array of interrelated, analogous facts that the biologist finds himself able to deal with novel situations. By means of the geological record on the one hand and the results obtained in the field and laboratory on the other, he acquires a better and better

understanding. His principal weapon is always inductive reasoning. It seems certain that a deductive treatment of biology is at least very remote and if ever accomplished will be utterly different from anything which we can imagine to-day. There are, however, a few special fields like the theory of heredity, in which a considerable mathematical structure has been developed. In this theory, by means of the "chromosomes" and their corresponding abstract "genes," it has been possible to explain a complicated array of facts.

The faith of the biologist generally tends in the direction of a mechanistic theory of life or of some opposing vitalistic theory. In fact, he is forced to employ the principle of physical causation in his efforts to understand biological phenomena and does not yet know of definite limitations in its use. Recently there has been some indication of a return to vitalism, so that once more a considerable group of biologists are convinced that not all the phenomena of living matter are to be accounted for by ordinary physical and chemical law. The controversy involved has long been a burning one, and accordingly one naturally suspects that the question is really meaningless. In any case, however, special mechanistic hypotheses have so far pointed the way to new creative advances.

It is interesting to remark that the insufficiency of a rigorously deterministic theory of the living organism admits almost of mathematical demonstration in the following manner. A genuinely mechanistic universe would have to be free of any infinite factors. For example, if one accepts a simple Newtonian theory, there might be reaching the earth from infinite space unknown quantities of matter and energy, so as to change arbitrarily the course of events upon the earth. But in any completely mechanistic system, free of such infinite factors, it is not difficult to prove that there will necessarily be a kind of eternal Nietzschean recurrence. For instance, we are here together this evening considering a particular topic. The strict adherence to the deterministic point of view would entail the consequence that in the eons yet to come this same scene will be re-enacted infinitely often. I submit that this is dramatically improbable!

Recent advances in the chemical knowledge of large organic molecules seem to indicate an innate hospitality of actual matter toward the evolution of the living organism. In this way a plausible genetic account of the origin of life is suggested, which, however, can scarcely be called mechanistic. It begins to seem possible that we are on the verge of further refinements in our concept of matter, such as Emerson anticipated in the quotation made above.

The situation at the psychological level is even less

amenable to precise treatment. All of us have a lifelong experience with ourselves and other human beings. This automatically gives rise to a vast complex of intuitive psychological notions. We all are aware of course that there are concomitant physiological processes going on in the body, nervous system and brain. Now it is the business of the professional psychologist to give exact definition and interpretation to these crude ideas; and he finds his greatest illumination in the facts of abnormal psychology, with which most of us are unacquainted. However, in the case of either layman or professional the processes of reasoning are mainly by analogy. Even the psychiatrist, familiar with many concrete cases, must treat each new patient by the inductive method. There are too many psychological intuitions and too few exact laws for any imposing edifice of pure reason to be erected.

In certain restricted psychological domains, formalization is to some extent possible. Thus I have ventured to formulate a theory of "esthetic measure," by explicit numeration and weighting of esthetic factors. This aims to explain certain simple esthetic facts in our enjoyment of visual and auditory forms. The theory has been to some extent substantiated by experiments made at Harvard and elsewhere. But in any case, no matter how successful the theory might prove, it would be wholly absurd to try to set up an elaborate logical structure on the basis of the fairly arbitrary and inexact assumptions involved. Generally speaking, as we proceed from the more objective to the more subjective levels of thought, we find that elaborate logical structures seem to be of less and less utility.

The basic belief of the professional psychologist is in the completeness of the physiological accompaniment of every psychical fact; and he formalizes the observed facts by means of the parallelism. But there is a conflict between this attitude of the technician towards mind, for whom the individual is a complex of neurally characterized components, and that of the ordinary man—equally an expert though of a different kind—who sees all sorts of permanent values in personality, not adequately characterized in neural terms. The second attitude leads nearly all of us to have deep affections and abiding personal loyalties, whether or not we are psychologists!

Here again I think that these apparently opposing points of view are both more or less true; and I incline all the more to this opinion because of my conviction that as yet we know relatively little about the phenomena of personality. For it seems certain to me that the extent of hidden organization in our universe is infinite, outside as well as inside of space and time; such a conviction is very natural to a mathematician, since the three ordinary spatial dimensions

and the single temporal dimension are for him only particular instances of infinitely many other conceivable dimensions! If this be true, any broad conclusions concerning the nature of personality would seem altogether premature.

At the social level the most serviceable intuitive ideas cluster around the concept of societal evolution. It is of course the comparative study of human institutions which furnishes the principal interest. The analogy between forms of society and evolving organisms is a deep-lying one. Here again the useful logical structure which can be built around the very complicated facts is exceedingly simple. Even in such a formalized field as ethics, dealing with the behavior of the individual as a member of society, logic plays an almost negligible role.

Belief here seems to gather principally around the idea of societal progress. Progress—or its non-existence—serves as our fundamental tenet. Some believe that society can improve indefinitely, tending toward a perfect society. Such a belief is of course a fundamental one in most religious systems. Others find this idea too naive. They stress the gregarious instinct in man and tend to think of societal changes as taking place in various directions strongly conditioned by changing physical environment. All would admit, however, that without the concept of dynamical social processes, social theorizing would be stale and unprofitable.

Let us turn now to consider some further conclusions, towards which this brief survey of intuition, reason and faith at the various levels seems to point.

As far as intuition and reason are concerned, these are the common property of all competent individuals. The narrow, closely articulated chains of deductive reasoning serviceable at the earlier levels are more and more replaced by loose webs of inductive reasoning at the later levels, as we pass from the objective to the subjective. At the same time the basic intuitions change from the simple and precise types employed in mathematics and physics to the increasingly complicated and diverse forms characteristic of biological, psychological and social phenomena.

However, it is just as necessary to clarify and to formalize our knowledge at these later levels as at the earlier ones. The processes of systematic reasoning, whether inductive or deductive, have always a definite prophylactic value, and in particular enable us to avoid the dangers of prejudiced and intolerant points of view. It may be observed in passing that the careful application of impartial thoroughgoing analysis is as important for everyday living as it is in the study and the laboratory.

The striving for rational comprehension is one of

the noblest attributes of man. In his age-long difficult struggle he has been able to secure greater freedom only through a better technical mastery of his environment. No other method of liberation has been vouchsafed to him. But this increased mastery has brought with it automatically new intellectual responsibilities and a more complex way of life. In consequence, unforeseen and threatening dangers arise from time to time; and there is thus imposed on him the necessity to advance still further, which is to-day more urgent than ever before.

A new injunction has been laid upon the spirit of man, to know and to understand ever more broadly and deeply.³

Now along with the increase in scientific knowledge there appear certain crudely expressed, deeper insights, not completely true or false, some in opposition to others, but all supremely valuable nevertheless. These are embodied in beliefs which seem the inevitable accompaniment of all creative thought.

Thus in the daring effort of the scientist to extend knowledge as far as possible, there arises an aura of faith. It is this spontaneous faith which furnishes the most powerful incentive and is the best guide to further progress.

Such are some of the very general points of view to which a considerable mathematical and scientific

experience has led me. If they are worthy of serious attention it is not because of their novelty, but rather because in their aggregate they rise above the details of the numerous specialized fields of knowledge and sustain the scientist in his unceasing and ardent search after truth.

Doubtless many of you are ready to ask the ever more insistent question: If science has thus profoundly modified the general outlook and way of life of mankind, is it not the especial duty of such an association as ours to point out constructive remedies for the ensuing maladjustments? In the "Part II: Science and Warfare" of his admirable address as president of the British Association last August Lord Rayleigh closed by expressing the hope that our two associations could cooperate in such a way as to "bear useful if modest fruit in promoting international amity." In this hope all of us will deeply concur. The presence of Sir Richard Gregory with us at the Richmond meeting is the first token of the projected closer relation between the parent British Association and ourselves. It is much to be desired that this action will encourage further unification of the whole scientific world. I am sure that practically all our joint membership would agree with me that it is the wider diffusion of "the steady light of scientific truth" which holds out most hope of a better understanding among men.

SCIENTIFIC EVENTS

THE PENNSYLVANIA CHEMICAL SOCIETY

A GROUP of Pennsylvania chemists received on December 14 a charter as "The Pennsylvania Chemical Society." Included among the incorporators are Dr. Edward R. Weidlein, director of the Mellon Institute at Pittsburgh, and Dr. Frank C. Whitmore, dean of the School of Chemistry and Physics at the Pennsylvania State College.

The society is incorporated "for the purpose of encouraging in the broadest and most liberal manner the advancement of chemistry as a science and as a profession in the Commonwealth of Pennsylvania, especially in fostering public welfare and education in matters involving chemistry, and aiding the development of industry and promoting the health, happiness and prosperity of the people of the Commonwealth. The society will carry forward the important role which chemistry has played in Pennsylvania from earliest Colonial times. Even prior to the establishment of this nation when the colonies and the early states were mainly dependent upon other foreign countries for many advances in science and also for most of their chemical necessities, there was formed in Penn-

sylvania what appears to be probably the first organization on the American Continent for the production of chemical products upon an industrial basis. Pennsylvania has mothered American chemical industry and been the seat of much distinguished work in the profession. Pennsylvania has led in the formation of institutions of learning from which there have gone forth innumerable chemists to teach others throughout the land how best to make use of the science and how to serve the commonwealth, the nation and themselves in an adequate capacity."

The officers of the society are as follows:

President—Dr. Jos. W. E. Harrisson, consulting chemist, member of the firm of LaWall and Harrisson of Philadelphia, assistant professor at the Philadelphia College of Pharmacy and Science.

Vice-president—Dr. Nelson W. Taylor, of the School of Mineral Industries, Pennsylvania State College.

Secretary and Treasurer—Dr. Elliott P. Barrett, member of the staff of the Mellon Institute for Industrial Research, Pittsburgh.

The society will shortly hold a meeting for formal acceptance of the articles of incorporation and will actively proceed with its corporate purposes.

³ From my circular Association letter of 1936.

OFFICERS OF THE AMERICAN CHEMICAL SOCIETY

DR. SAMUEL COLVILLE LIND, dean of the Institute of Technology of the University of Minnesota, has been elected president of the American Chemical Society for 1940. Dr. Lind will take office as president-elect on January 1, 1939, at which time Professor Charles A. Kraus, of Brown University, becomes president, succeeding Dean Frank C. Whitmore, of Pennsylvania State College.

The new president-elect was chosen by the council from four nominees receiving the largest number of votes in a national poll by mail by more than 22,000 members of the society. The council includes national officers, directors, editors of publications, past presidents, chairmen of professional divisions and councilors of the eighty-five local sections.

Dr. Lind, who has been editor of the *Journal of Physical Chemistry* since 1933, has been a leader of chemical research in the field of radioactivity, radium extraction and measurement, influence of radiation on chemical action, kinetics and chemical reactions, photochemistry and chemical effects in electrical discharge. He originated the ionization theory of the chemical effects of radium rays and invented the Lind interchangeable electroscopes of radium measurements.

He taught at the Massachusetts Institute of Technology in 1902-03 and at the University of Michigan from 1905 to 1915. He has been associated with the United States Bureau of Mines since 1913, first as chemist in radioactivity and since 1918 as physical chemist. He was chief chemist of the bureau from 1923 to 1925 and associate director of the Fixed Nitrogen Research Laboratory, Washington, D. C., in 1925-26. Before becoming dean of the Institute of Technology in 1935, he was director of its School of Chemistry for nine years.

Three directors and four councilors-at-large have been elected as follows:

Directors

Dr. E. R. Weidlein, director of the Mellon Institute of Industrial Research, Pittsburgh, and past president of the society, elected from the third district, comprising Pennsylvania, Delaware and Ohio.

Thomas Midgley, Jr., of Worthington, Ohio, vice-president of the Ethyl Gasoline Corporation, reelected director-at-large.

Professor Arthur J. Hill, chairman of the department of chemistry of Yale University, reelected from the first district, including Connecticut, Massachusetts, Rhode Island, Maine, New Hampshire, Vermont and Canada.

Councilors-at-large

Dr. George D. Beal, assistant director of the Mellon Institute, Pittsburgh.

Dr. Henry Gilman, professor of organic chemistry at the Iowa State College.

Dr. Harry N. Holmes, head of the department of chemistry of Oberlin College.

Professor Harold C. Urey, professor of chemistry at Columbia University.

THE AMERICAN GEOGRAPHICAL SOCIETY

At the regular monthly meeting of the American Geographical Society held in the auditorium of the American Museum of Natural History, Roland L. Redmond, president of the society, announced that Dr. John Kirtland Wright had been appointed director of the society. His appointment is effective immediately.

Dr. Wright graduated from Harvard College in 1913 and received the Ph.D. degree in 1922. He has been on the staff of the American Geographical Society since 1920, as librarian from 1920 to 1937 and since then as research editor. His main interests lie in the fields of historical geography, population studies and geographical bibliography, on which subjects he has published books and periodical articles. He has also edited several of the publications of the society, notably "New England's Prospect: 1933" and Dr. C. O. Paullin's monumental "Atlas of the Historical Geography of the United States," which was published jointly with the Carnegie Institution of Washington.

Founded in 1852, the American Geographical Society is the oldest geographical society in the United States and the leading research institution of its kind. In 1915, with a reorganization of the staff, Dr. Isaiah Bowman was appointed as the first director, a position that he held until 1935, when he assumed the presidency of the Johns Hopkins University, Baltimore. During the twenty years of Dr. Bowman's directorship the activities of the society were greatly enlarged. Many projects of research were undertaken, among them the compilation and publication of a great map of Latin America in 107 sheets (now nearing completion), as well as studies of the polar regions and of the parts of the world that are still open to pioneer settlement. Some fifty authoritative books dealing with nearly all phases of geography have been issued by the society since 1915, and the society on several occasions has been called into consultation by the Government.

Included on its council are: Isaiah Bowman, Charles R. Crane, F. Trubee Davison, Lincoln Ellsworth, John H. Finley, William Hale Harkness, H. Stuart Hotchkiss, Archer M. Huntington, Arthur Curtiss James, Wesley C. Mitchell, Frank L. Polk, William A. Rockefeller, Carl C. Shippee.

AWARD OF THE EDISON MEDAL OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

DR. DUGALD C. JACKSON, professor emeritus of electrical engineering at the Massachusetts Institute of Technology, has been awarded the 1938 Edison Medal

of the American Institute of Electrical Engineers "for outstanding and inspiring leadership in engineering education and in the fields of generation and distribution of electric power." The presentation will be made on the evening of January 25, during the annual winter convention of the institute, which will be held in the Engineering Societies Building, New York.

Dr. Jackson's early engineering experience was gained as vice-president and engineer from 1887 to 1889, for the Western Engineering Company at Lincoln, Nebr. He was assistant chief engineer with the Sprague Electric Railway and Motor Company, New York City, from 1889 to 1891, and later was chief engineer for the central district of the Edison General Electric Company. In 1891, he formed a consulting engineering firm with his brother, W. B. Jackson, and also became professor of electrical engineering at the University of Wisconsin. In 1907 he was appointed professor and head of the department of electrical engineering at the Massachusetts Institute of Technology, becoming professor emeritus in 1935. He continued as senior partner of the consulting engineering firm of Jackson and Moreland, organized in 1919, until 1930.

Dr. Jackson joined the American Institute of Electrical Engineers in 1887. He has been member and chairman of many institute committees, and was vice-president, 1897-99, and president, 1910-11. He has been president of the Boston Society of Civil Engineers and of the Society for the Promotion of Engineering Education and is president of the American Institute of Consulting Engineers. He is president of the American Academy of Arts and Sciences, and was a member of the National Research Council from 1928 to 1936. He has published five books on electrical engineering and approximately 150 articles related to engineering projects and engineering education. Dr. Jackson served in France as lieutenant-colonel of engineers during the latter part of the World War, and is Chevalier of the French Legion of Honor.

The Edison Medal, founded by associates and friends of Thomas A. Edison to perpetuate his memory, is awarded annually for "meritorious achievement in electrical science, electrical engineering or the electrical arts" by a committee of twenty-four of the leading members of the American Institute of Electrical Engineers. Previous recipients have been Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell, Nikola Tesla, John J. Carty, Benjamin G. Lamme, W. L. R. Emmet, Michael I. Pupin, Cummings C. Chesney, Robert A. Millikan, John W. Lieb, John White Howell, Harris J. Ryan, William D. Coolidge, Frank B. Jewett, Charles F. Scott, Frank Conrad, Edwin W. Rice, Jr., Baneroff Gherardi, A. E. Kennelly,

Willis R. Whitney, Lewis B. Stillwell, Alex Dow and Gano Dunn.

ADDRESS OF THE PRESIDENT OF THE ROYAL SOCIETY INTRODUCING THE PILGRIM TRUST LECTURER

At a meeting of the Royal Society on December 8 held at the Royal Institution, the president of the Royal Society, Sir William Bragg, delivered the following speech preparatory to the Pilgrim Trust Lecture by Dr. Irving Langmuir. He spoke as follows:

The principal business of this afternoon has a significance which is at once important, interesting and welcome. We are to hear an address from one of the greatest scientists of the United States, honored throughout the world. In introducing him to you I must tell you in a few words why he has come, and what his coming means to us.

Rather more than a year ago, Professor L. J. Henderson, of Harvard University, foreign secretary to the National Academy of Sciences of Washington, was a visitor to this country and had many meetings with fellows of our (Royal) society. At one of these meetings the suggestion was made that there would be valuable results if direct cooperation could be established between the National Academy and our society. It was thought that a first step in this direction would be made if lecturers could be interchanged between the two bodies and the countries which they represented. The Pilgrim Trust was approached, and a most generous response was made. The trust promised to give £250 guineas a year for six years in order that a good trial might be made of a suitable scheme. Finally, it was proposed that in alternate years an American scientist should be invited to England by our society, and a British scientist invited to America by the academy. The two societies gladly endorsed the proposal in October of last year. The presence of Dr. Irving Langmuir, invited by our society, is the first realization of the scheme.

I should explain for the benefit of some who may not be familiar with the scientific institutions of America that the National Academy occupies a foremost place in the States. It corresponds in many ways with our society. Our society is proud to be associated with an institution of such high standing; our relations with it have always been most friendly, and we are glad indeed that they are to be strengthened still further by this new bond between us.

Dr. Irving Langmuir was chosen without any hesitation as the man whom we would most like to see in Britain as our first Pilgrim Trust lecturer. He has already done famous things both in pure science and its applications. No doubt there are many who know what he has done for the great illumination problems. The modern electric lamp, with its filling of gas, is largely his creation, and the electron discharge has been developed by him so as to become one of the useful tools of industry. His work on the nature, properties and handling of molecular films spread on the surfaces of liquids is admired and copied in every laboratory of distinction. He has new work on

this subject to describe to us this afternoon, work which makes a notable addition to the subject of biochemistry. We are very happy that America should spare to us for this visit a man who has done so much for the reputation of American science, and we are very ready to learn what he has to teach us.

Our society has sought to pay its respect to Langmuir's work by the award of the Hughes Medal in 1918, and by electing him as a foreign member of our body. He re-

ceived the Nobel Prize for chemistry in 1932. The American Academy of Arts and Sciences gave him the Rumford Medal in 1920.

It is an interesting fact that this Rumford Medal is the parallel of our own Rumford Medal, in that the two were founded by the same great scientist. I may draw your attention to a further interesting fact, that Rumford the American was the originator of the Royal Institution where we meet to-day.

SCIENTIFIC NOTES AND NEWS

THE American Association for the Advancement of Science and a large number of affiliated and associated societies are holding meetings in Richmond during the present week, under the presidency of Dr. S. A. Mitchell, professor of economics in Columbia University. A preliminary program, edited by Dr. F. R. Moulton, permanent secretary, was printed in the issue of *SCIENCE* for December 2. Full accounts of the meeting and a number of the more important addresses will appear subsequently. The address of the retiring president, Dr. George D. Birkhoff, will be found in the present issue.

THE election of the following sectional presidents of the British Association has been announced: *Mathematical and Physical Sciences*, R. S. Whipple; *Chemistry*, Professor E. K. Rideal; *Geology*, Professor H. H. Read; *Zoology*, Professor J. Ritchie; *Geography*, A. Stevens; *Economics*, Professor H. O. Meredith; *Engineering*, H. E. Wimperis; *Anthropology*, Professor W. E. Le Gros Clark; *Physiology*, Professor D. Burns; *Psychology*, R. J. Bartlett; *Botany*, Professor D. Thoday; *Education*, Dr. A. P. M. Fleming; *Agriculture*, Sir Thomas Middleton. The annual meeting in 1939 will be held at Dundee from August 30 to September 6, under the presidency of Sir Albert Seward.

PROFESSOR D. W. JOHNSON, professor of physiography at Columbia University; Professor H. von Ecker-mann, assistant professor of mineralogy and crystallography in the University of Stockholm, and Professor A. A. Öpik, professor of geology in the University of Esthonia, have been elected foreign correspondents of the Geological Society of London. Professor Emile Argand, professor of geology, mineralogy, petrography and paleontology in the University of Neuchâtel, and Dr. E. A. Stensiö, director of the department of paleozoology in the Naturhistoriska Riksmuseum, Stockholm, have been elected foreign fellows.

DR. H. B. WALKER, of the College of Agriculture of the University of California, was awarded the John Deere Medal for 1939 of the American Society of Agricultural Engineers in recognition of his "disting-

guished achievement in the application of science and art to the soil" at the Chicago meeting. The medal was given to the society for annual award by descendants of John Deere, inventor of the first all-steel plow. Last year for the first time it was awarded to S. H. McCrory, of the U. S. Department of Agriculture. The presentation to Dr. Walker will be made at the annual meeting of the American Society of Agricultural Engineers to be held at the University of Minnesota next June.

AT the hundred and ninety-fourth convocation of the University of Chicago the honorary doctorate of science was conferred on Dr. James B. Herrick, who retired in 1926 as emeritus professor of medicine of the Rush Medical College. Dr. Emmet B. Bay, dean of Rush Medical College, a former student and associate, presented Dr. Herrick for the degree. The citation read: "Scholarly teacher and devoted physician, whose character and attainments have adorned this university and whose contributions to knowledge have enriched the annals of medical science."

THE University of Paris has conferred honorary degrees on Dr. Albert von Szent-Györgyi, professor of medical chemistry in the faculty of medicine of the University of Szeged; on Dr. S. P. L. Sorenson, director of the chemical section of the Carlsberg Laboratory, Copenhagen, and on Dr. Paul Karrer, director of the Institute of Chemistry at the University of Zurich.

TRINITY COLLEGE, Dublin, conferred on December 8 the honorary degree of doctor of science on Dr. E. S. Goodrich, professor of zoology and comparative anatomy at the University of Oxford.

Museum News reports that the Inter-Museum Council of New York City, at a meeting of representatives of about thirty institutions held on November 4, elected Dr. Clark Wissler, of the American Museum of Natural History, *chairman*; Hardinge Scholle, Museum of the City of New York, *vice-chairman*, and Robert P. Shaw, of the New York Museum of Science and Industry, *secretary-treasurer*.

DR. ERNEST E. TYZZER, George Fabyan professor of comparative pathology at Harvard Medical School,

who succeeded Dr. Richard P. Strong when he retired last autumn as professor of tropical medicine, has been appointed head of the combined departments of tropical medicine and comparative pathology.

DR. JOHN C. WHITEHORN, physiological chemist and director of laboratories at McLean Hospital, Belmont, Mass., has been appointed professor of psychiatry in the Washington University School of Medicine, St. Louis. The department of neuropsychiatry of the medical school has received from the Rockefeller Foundation a grant of \$150,000 to assist in the development of research and teaching.

DR. K. W. MEISSNER, formerly professor of physics in the University of Frankfurt-am-Main, Germany, has joined the staff of the department of physics of the Worcester Polytechnic Institute.

DR. F. A. PANETH, reader in atomic chemistry in the University of London, has been appointed professor of chemistry at the University of Durham. He succeeds Professor Irvine Masson, who recently resigned to become vice-chancellor of the University of Sheffield.

At the Museum of Zoology of the University of Cambridge, F. T. Parrington, of Sidney Sussex College, has been appointed director. Other appointments include H. B. Cott, of Selwyn College, curator of vertebrates and Strickland curator; J. E. Smith, curator of invertebrates; Dr. G. C. Varley, of Sidney Sussex College, curator of insects. He was also appointed university demonstrator in zoology.

MISS MARGARET POOR has been appointed assistant entomologist at the Bernice P. Bishop Museum, Honolulu.

DR. JOHN VAN OOSTEN, in charge of Great Lakes Investigations of the U. S. Bureau of Fisheries, has become a member of the water resources committees of the National Resources Committee for the Upper Great Lakes (Superior, Michigan and Huron) and the Lake Erie basins.

CLINTON G. ABBOTT, director of the Natural History Museum, San Diego, Calif., has been appointed a member of the State Committee of Parks, Parkways and Recreational Facilities.

DR. JOHN F. CUNNINGHAM, dean of the College of Agriculture of the Ohio State University, has been named chairman of the resident teaching section of the Association of Land Grant Colleges and Universities.

DR. G. F. LOUGHLIN, chief geologist, and L. W. Currier, geologist, of the U. S. Geological Survey, recently conferred in Boston with officials of the Massachusetts Department of Public Works in regard to the plans

for an accomplishment of geologic investigations in the state that are being undertaken by the Geological Survey in cooperation with the state. These investigations include geologic mapping of various areas and the preparation of reports to state engineers on road building projects, etc.

At a meeting in Washington of the Board of Trustees of the National Geographic Society four life trustees were elected as follows: Rear Admiral L. O. Colbert, director of the Coast and Geodetic Survey; Major General Henry H. Arnold, chief of the U. S. Army Air Corps; Dr. Floyd K. Richtmyer, dean of the Graduate School of Cornell University, and Leroy A. Lincoln, president of the Metropolitan Life Insurance Company of New York.

CHARLES M. B. CADWALADER, president of the Academy of Natural Sciences of Philadelphia, has been elected to the board of managers of the Wistar Institute of Anatomy and Biology and to the board of trustees of the Wagner Free Institute of Science.

A NUTRITION PANEL, consisting of food experts and scientific men in every branch of research and industry, has been announced by the Food Group of the Society of Chemical Industry of Great Britain. The panel, with Dr. J. C. Drummond, professor of biochemistry at the University of London, as chairman, and A. L. Bacharach as honorary secretary, has been formed for the study of food in relation to health and disease. Its scope will include the production, processing and distribution of food for both human and animal consumption and the manufacture and control of preparations for supplementing diets for medical use in the nutritional disorders. Regular meetings of members are being arranged and subjects to be discussed will range from vitamins to food storage in national emergency and animal nutrition.

DR. IRVING LANGMUIR, of the General Electric Company, who is in England to give the first lecture established by the Pilgrim Trust, gave an address before the Physical Society of London on December 20. He spoke on "The Structure of Prolan."

H. D. MISER, geologist in charge of the section of fuels, U. S. Geological Survey, delivered his presidential address as retiring president of the Geological Society of Washington on December 14. His subject was "Our Petroleum Supply."

DR. PETER H. BUCK, professor of anthropology at Yale University and director of the Bishop Museum, Honolulu, addressed students of Mills College, California, on December 14.

AN inaugural lecture was given on November 28 by Professor J. D. Bernal, who was recently appointed to the university chair of physics at Birkbeck College,

University of London. He spoke on "The Structure of Solids as a Link between Physics and Chemistry."

THE annual conference of the British Geographical Association will be held at the London School of Economics from January 3 to 6, under the presidency of Sir Thomas Holland. The subject of Sir Thomas's address will be "The Geography of Minerals." The Institute of British Geographers will hold its annual meeting at the same time and place.

COMMEMORATING the thirty-fifth anniversary of the first flight of the Wright Brothers at Kitty Hawk, N. C., on December 17, 1903, the New York Museum of Science and Industry, in Rockefeller Center, opened on that day a special aeronautical exhibition with the emphasis on flying for the civilian. Airplane models, a full-sized all-metal plane designed for the amateur flyer, together with material showing how an all-metal plane is constructed, and an exhibit of aerial cameras make up the exhibition. Among the models, which number about thirty military, naval and commercial airplanes and flying boats, is one of the original Wright planes. A model of the Wright Brothers memorial at Kitty Hawk is also shown.

A HABITAT group containing the world's largest gorilla was opened on December 16 in the African Hall of the Academy of Natural Sciences, Philadelphia. The group was collected and presented to the academy by George Vanderbilt, of New York, who, with Mrs. Vanderbilt, attended a private opening of his group and a dinner given in their honor by Charles M. B. Cadwalader, president of the academy.

By the will of the late Edward Benedict Cobb, Yale University receives, in addition to a bequest of \$400,000, an interest in the residuary estate of \$1,400,000.

ARCHES NATIONAL MONUMENT, Utah, one of a group known as the Southwestern National Monuments, administered by the National Park Service, has been increased in area more than six times. The extension adds four sections of much scenic value, related in geologic formation to the original area of 4,520 acres, set aside in 1929. These sections are known as the Devil's Garden, the Courthouse Towers, the "Klondike" and part of the Canyon of the Colorado River. Produced by centuries of water and wind erosion, the monument consists of a series of arches, natural bridges and windows, with balanced rocks, pinnacles and other shapes eroded from the basic red sandstone. Petrified remains of dinosaur bones have been found in the vicinity, as well as well-preserved dinosaur tracks. The canyon walls bear Indian petroglyphs, showing evidences of early Indian occupancy.

The Museum News calls attention to a recent report issued by the Dominion Bureau of Statistics of Canada enumerating 36 museums in the country with full-time

staffs. Twelve of these have the full time of only one person each. Thirteen have three or more full-time staff members. The annual expenditure of these museums is estimated at \$800,000 to \$900,000. The average daily attendance is highest at the Royal Ontario Museum, Toronto, with 688 visitors for the five museums; Vancouver City Museum has 400; the Art Gallery of Toronto, 372; the Hudson's Bay Company exhibit at Winnipeg, 235; and the National Gallery, Ottawa, and the Chateau de Ramezay, Montreal, 200 each. A directory of all Canadian museums is included in the report.

THE Rothamsted Experimental Station at Harpenden, England, the oldest agricultural research station in the world, will celebrate its centenary in 1943. To mark the occasion it has been decided to carry out a plan of extension, and an appeal has been made for a fund of £125,000. It is proposed that the fund should be allocated as follows: Chemical laboratory new wing, £15,000; alterations to old chemical laboratory, £3,000; equipment, £3,000; pot culture houses and accessories, £5,000; farm buildings and cottages, £4,000; forecourt, £3,000; new agricultural library, with cubicles for workers, £20,000; new building for the Imperial Bureau of Soil Science and other workers associated with overseas activities, conference hall, etc., £30,000, and additions to endowment to provide upkeep of buildings, fellowships and salary augmentations, £42,000. It is hoped that it will be possible to complete the building program in advance of the celebration in 1943.

A CORRESPONDENT of the *London Times* writes that Dr. Knox Shaw, of the Radcliffe Observatory, Pretoria, has received news that the mirror of the big telescope for the observatory has been cast successfully by the Corning Glass Works, of Corning, N. Y. The work of casting began in May. The mirror has now to go to Great Britain to the telescope makers, Messrs. Howard Grubb, Parsons and Company, to be ground and polished. If all goes well the telescope may be expected to arrive in South Africa towards the middle of 1939. This is the third attempt to cast the mirror, which is 72 inches in diameter. The disk glass was originally ordered in July, 1936, but in December of that year the casting proved a failure. Another mirror was cast in June, 1937, and that also was found to be a failure in September of 1937. Until the mirror arrives in Pretoria the work of completing the observatory is held up, but everything is in readiness to accommodate the telescope.

At the autumn meeting of the Zoological Section of the South-Eastern Union of Scientific Societies held at the Zoological Society of London, Sir Edward Poulton was in the chair. Dr. Julian Huxley, F.R.S., the president of the union for 1938, introduced the

program, which consisted of three biological films—*Mites and Monsters* (Strand Films), *Heredity in Animals* (G. B. Instructional) and *The Private Life of the Gannets* (London Films)—in all of which he had acted as scientific adviser. *Mites and Monsters* is designed for commercial showing, but with the aim of putting across certain definite ideas concerning the

size of animals and its limitations in different groups. *Heredity in Animals* is a purely educational film, designed to explain the elementary facts of Mendelism and selection to boys and girls in the higher classes of secondary schools, and *The Private Life of the Gannets* is a straightforward nature film, aimed simply at interesting the general public.

DISCUSSION

EVIDENCE OF THE AUSTRALOPITHECINE MAN-APES ON THE ORIGIN OF MAN

A RECENT visit to South Africa, in response to cordial invitations from Dr. Robert Broom, of the Transvaal Museum, Pretoria, and Professor Raymond A. Dart, of the Medical School of the University of the Witwatersrand, Johannesburg, was undertaken by us for the purpose of making a close study of the dentition of the Pleistocene South African man-apes described by Dart (1925)¹ and Broom (1936, 1938).² The full report of our results is being sent for publication by the Transvaal Museum, but in view of the exceptional importance of Dr. Broom's discoveries, the following brief note may be of interest to readers of SCIENCE.

We found that the forms called *Plesianthropus transvaalensis* and *Paranthropus robustus* by Broom displayed in their adult dentitions the following characters which are transitional or intermediate between the ape and human stages: (1) the upper and lower canine teeth, apparently in males as well as females, were of relatively small size, with low tips, and were altogether more human than ape-like; (2) the third upper and lower molars were very large, in contrast to the usually short third molars of man; (3) the second upper molar was larger than the first, as in apes; (4) the third lower molar crown pattern was evidently a derivative of the ancestral five-cusped "*Dryopithecus* pattern,"³ but it was approaching the human "plus pattern" in the arrangement of its grooves and bore a large sixth cusp as in certain primitive men; (5) the grinding teeth when well worn acquired nearly flat occlusal surfaces as in man, whereas in apes the buccal cusps of the upper, and the lingual cusps on the lower, tooth rows, tend to remain in high relief even in well-worn specimens; (6) in the upper dental arch of *Plesianthropus*, as carefully reconstructed by us, the sides were slightly divergent posteriorly and the general effect was more human than ape-like; (7) in correlation with the small size and low crown of the upper

canine, the first lower premolar had a convex buccal face and showed little or no trace of the shearing mesio-buccal face which is found in the ancestral *Dryopithecus* stock, where it sheared against the distolingual face of the tusk-like upper canine. Thus the first lower premolars in *Paranthropus* were almost human in stage.

On the whole the adult dentition of the South African Pleistocene man-apes was somewhat more human than ape-like in the small canines and premolariform first lower premolars, as well as in the flattening of the crowns of the grinding teeth by wear, in the form of the upper dental arch and in the great development of cusp 6 on the lower molars. On the other hand, it was more ape-like than human in the large size of the second and third upper and lower molars and in retaining the *Dryopithecus* pattern on all the lower molars.

The deciduous dentition, which is well preserved in the young skull of *Australopithecus africanus* Dart, is more human than ape-like in the reduction of the incisors and canines, in the advanced submolariform patterns of the upper and lower deciduous molars, in the shortness and width of the deciduous dental arches; on the other hand, the relatively huge size of its permanent upper and lower molars, together with their characteristic crown patterns, indicate that this is the young of one of the adult forms noted above and serve to mark its definitely infra-human status.

These conclusions are confirmed by the annectant characters of the braincase as recently figured by Broom. The smaller adult braincase, provisionally estimated by Broom as about 440 cc, although not as large as that of a large gorilla, is more human in general appearance. The larger braincase, estimated by Broom at about 600 cc, is not unlike that of *Pithecanthropus erectus*, but definitely smaller.⁴

In 1926 H. H. Wilder, in his excellent book, "The Pedigree of the Human Race," took the bold step of uniting apes and men in a single zoological family, the Hominidae. If mice rather than men were being classified, this would have been widely recognized as a genuine discovery, in line with the more fundamental one by Linnaeus that man is a member of the natural

¹ *Nature*, 115: 2884, 195-199, February 7, 1925.

² *Nature*, 138: 3490, 468-488, September 19, 1936; *ibid.*, 142: 3591, 377-379, August 27, 1938.

³ William K. Gregory, 1916. *Bull. Am. Mus. Nat. Hist.*, Vol. XXXV, art. 19, pp. 239-355, *Dryopithecus* pattern, pp. 293-295. Gregory and Hellman, 1926; Hellman, 1928.

⁴ *Nature*, 142: 3603, 897-899, November 19, 1938.

order Primates. But most of the clergy, innumerable educators and a vast majority of the laity can not stomach the Linnaean classification because it brackets with the "brute beasts" that self-conscious and conceited prig who calls himself *Homo sapiens* and is fond of acting like the viceroy of God. The supposed phylogenetic isolation of man is even a favorite theme of those scientists who rest their beliefs upon an uncritical acceptance of catch-words such as "polyphyletism," "parallelism," "irreversibility of evolution," and the like.

While the myth of the Eocene dawn-man will doubtless continue to flourish, the small-brained Pleistocene man-apes of South Africa now add their mute testimony that man, like his less ambitious cousins, the modern anthropoid apes, is a descendant of the late Tertiary dryopithecine ape stock of Europe, Asia and Africa, and that, as long maintained by us and more recently supported by Davidson Black, Weinert and Broom, the human status was gained through a long-continued and profound morphological revolution during the Pliocene and early Pleistocene epochs.

WILLIAM K. GREGORY
MILO HELLMAN

AMERICAN MUSEUM OF
NATURAL HISTORY

SOME NOTES ON THE NEW ENGLAND HURRICANE OF 1938, MADE AT WORCESTER, MASS.

THE hurricane arrived so inconspicuously that hardly any one noticed its arrival. The Weather Bureau forecast in the papers sold on the street up to the time of the storm made no suggestion that anything unusual might occur. The wind was blowing hard in the middle of the afternoon, but no one thought anything of that. There were none of the ordinary signs of storm, no heavy black clouds, no suggestion of lightning. Instead, the wind came from slightly east of south, a direction from which we usually get mild weather, and the sky was overcast with a feeble attempt at rain.

The first, within my personal contacts, to recognize danger was our family cat. Previously she had insisted that her family be kept upstairs, but as the storm approached she came down the stairs with a kitten in her mouth, hid it under the couch while she went to the cellar to find a better refuge for her family.

The wind continued to increase, but no one thought anything of that. The clouds started to break up and the rain practically stopped. Now we could see two distinct layers of clouds, a high layer which appeared stationary, and a very low layer of light fleecy clouds moving rapidly from a little east of south. If the light fleecy clouds were near the top of the hurricane layer, as we would expect, it would suggest that the

storm was confined to a very thin layer of air, compared to most storms.

Next we saw workmen on the roof of a nearby factory building, trying to fasten down the roof covering, which was working loose. But the attempt was soon abandoned, and we saw the roofing paper torn loose and blown away. Still I thought nothing of the severity of the storm. With no signs of storm present except the severity of the wind, how could it be anything unusual? I wondered at the weakness of construction, how people could be so careless as to put on a roof covering in such a way that the wind could blow it off. Next we saw the edging of the roof rise and fall with each gust of wind, like a wave a few inches high running the full length of the building, and I wondered what kind of trimming this could be. It was not till this had been going on for a half hour or longer that it rose higher than usual, and I noticed that it was the entire roof, leaving the brick wall standing alone. Finally, after the wind appeared to be diminishing, the brick wall in one section gave way under the repeated hammering, buckling slowly, as it seemed, letting the roof beams fall to the floor below. The worst of the storm was now passed, and the wind was insufficient to cause further damage.

At the height of the storm closing time came at our factory. For some time, no effort had been made to keep any one at work, but most of the employees made an attempt at work between the intermissions at the windows. Now the employees, all young men, cleaned up and left for home as usual. The sensible thing to have done was to have stayed in a solidly built building like ours, to wait for the fury of the storm to pass, but not one of my employees did so. Whenever we looked, there were people on foot and in automobiles making what progress they could, with bricks, signs and roofing materials falling on all sides. Probably the most astonishing thing about the storm in Worcester was that not a single person was killed by falling or blowing materials. Automobiles were demolished, but the people escaped.

I saw one building damaged, and further off two others appeared to have suffered. Others saw trees near them fall. But most of us thought that we saw some local trouble, that we had seen a piece of faulty construction, or a few trees weakened without our knowledge of it. It was not till after the storm, when I walked through a mile of continuous destruction, with hardly a hundred feet of open sidewalk at any point in that distance, that I began to realize the extent of the damage. Not until several days later did I realize that practically every building in the city was damaged to some extent, that church spires that looked sound were so weakened that it was decided to take them down rather than to repair. Not for a week did I dis-

cover that over our own building, which stood so solidly, with hardly a quiver from the wind, the roof was beginning to weaken. There was enough motion to start some of the joints, and several planks were noticeably loose.

Examination of the damage showed conclusively that it was not the force of the wind that alone caused the damage. Most of the buildings would have stood a considerably harder blow, if that was all. It was the continued motion that gradually loosened the joints and weakened the structures. It was the same with the trees. The motion pulled the roots up gradually, and after the storm many trees left standing were two or more inches higher at the base of the trunk than before. Often the roots at one side of the tree had been raised four to eight inches, letting the tree incline, but leaving it still solidly planted.

The storm was now practically over, but the wind, as closely as we could tell without instruments, was in the same direction. At the very center of the storm it was a straight blow, but we heard later that there had been a center of rotation a hundred miles or so west of the center of the storm, that at the center of rotation the damage was comparatively slight. If we look at the storm in the customary way, as a rotating mass of air, it is evident that some force must accelerate the air from nearly at rest to hurricane velocity and then almost stop it in each revolution. That must have been a great force, but what is its nature? How could a force be applied edgewise, that is, in a horizontal direction without causing the thin layer of air to buckle upwards? I will mention again that one of the most conspicuous features of the storm was its thinness, as indicated by the clouds, and not once did I notice a break in the uniform flow of light fleecy clouds. The traditional comparison with water flowing from a drain in the bottom of a wash basin was clearly not valid. A better comparison would be that of a thin layer of water, perhaps one-eighth inch thick, rotating at the bottom of the basin, while all the water above remained undisturbed, a thing which we never observe.

It appeared more like a mass of air from above, rolling down on the lower layers and squeezing them out. If that was the case, the observed rotation must have been only a secondary effect, an eddy at the side of the main storm, as it appeared to be. But if the wind velocity was the result of pressure from above, why the low barometer? Pressure would be expected to result in a high barometer. It suggests the familiar paradox of the flow of water in pipes, where reducing the size of pipe with a constant flow of water decreases the pressure also. It is the principle used in one form of vacuum pump, where, by making a hole in the side of the pipe where the diameter is smallest, suction is produced. Can a condition of this kind exist in the

air, where a pressure from above is not transmitted to the ground, but acts in such a way as to reduce the size of the channel through which the air is flowing, with a resulting reduction in pressure?

A. W. FORBES

WORCESTER, MASS.

OHIO PRO-GLACIAL LAKES

IN 1908¹ and 1914,² the author published notes on lake beds in central Ohio. Four beds were called Finger Lakes of Ohio and described as well as possible, after the reconnaissance survey then made. One of these was reported to have tilted shorelines. Both the presence of the lakes and the tilt were discredited at the time by other workers and the author subsided, not because of any doubt about his findings, but because of lack of time in the pressure of other work to go over the field in a more thorough way. The recent gift of retirement from active teaching granted by the generous provision of Oberlin College has made the necessary time available, and during the past summer eight to nine weeks has been given to intensive field studies by the author, assisted by a graduate student.

During the last twenty-five years a lookout for more lake beds has been maintained, and the studies carried on this summer have covered ten abandoned lake beds; five or six more are known, and their study is booked for next summer. One of the ten examined was not wholly finished.

The findings have some considerable geomorphologic interest and a little economic value. Speaking of the possible resources first we can report that silts are found in all lake beds. Several deposits are being worked for the manufacture of tile and brick. Clays were also found in several lake beds, but in only one is any industrial use made of the clay. Gravels and sands as beach deposits are scarce and have little value, but three deltas, large for such lakes, are known; all are opened for road material. Specific shoreline features are usually wanting around the borders of the lakes.

Of value in studies in American epirogeny is the complete confirmation of tilting described twenty-four years ago in Lake Craigton. It is now known that Lake Craigton is much larger than was claimed in the preliminary survey and report, and that the tilting amounts to eighty feet in eighteen-nineteen miles along a N-S axis. This lake has three arms, one northwest toward Ashland, one north toward West Salem, and the third south toward Big Prairie. The north arm is lifted up more than the northwestern arm, hence the maximum tilt is up in the northeast. Two other lake beds have length enough in this direction to show tilting.

¹ *Am. Jour. Sci.*, 25: 239-243, 1908.

² *SCIENCE*, 39: 470, March 27, 1914; *Am. Jour. Sci.*, 37: 444-450, May, 1914.

Two of the lakes were held in on one side for a time by the continental ice, in one case for a time long enough to permit building of a large subaqueous moraine.

These lake beds are all 200 feet or more above the Maumee Beach of the proglacial lake in the Erie basin,

and are in no way related to that lake. But their tilting carries the continental uplift thirty to forty miles farther south than the Maumee Beach and that much beyond any known tilt of the Great Lakes area.

GEORGE D. HUBBARD

OBERLIN COLLEGE

SUMMARY STATEMENT OF THE ACTIVITIES OF THE NATIONAL RESEARCH COUNCIL, 1937-1938

II

DENSITY CURRENTS

With the large number of power and storage reservoirs which have been constructed throughout the country in recent years a new problem of hydrodynamics has come to be recognized in the frequent occurrence in these reservoirs of streams or layers of water of a density or turbidity different from that of the surrounding body. The density of incoming waters varies with the salt content, with the temperature and with the burden of fine silt held in suspension. Currents of incoming water may move through a reservoir from entrance to exit without losing their identity by mixture with surrounding water. At other times turbulence causes a general or partial mixing. The problem consists of ascertaining the conditions which may cause or impede the general mixing of waters. It relates not only to waters in reservoirs and lakes but also to water at the confluence of rivers and to the meeting of fresh water with tide water. Among the practical applications of the problem are the determination of the quality of the waters impounded and likely to be delivered to the communities served by irrigation or urban water supply systems and estimates of the rate of filling of these reservoirs by the deposition of silt. An interdivisional committee has been appointed under the auspices of the Division of Geology and Geography to coordinate field observations which have been undertaken by several government agencies, including measurements in a number of reservoirs and natural lakes, such as Lake Mead on the Colorado River, Elephant Butte Reservoir in New Mexico, and several storage lakes in the Tennessee Valley.

RESEARCH IN PROBLEMS OF SEX

The Committee for Research in Problems of Sex has been enabled to continue its work for a period now of over sixteen years, supported by funds provided in the earlier years by Mr. John D. Rockefeller, Jr., and later by the Rockefeller Foundation. There seems to be no doubt that a large part of the advance-

ment of knowledge that has been achieved in this field in the United States is due directly to the continued financial support with which the committee has been provided for this purpose and to the stimulating effect upon these researches which integration of interest within this field has effected. At the beginning of the committee's work, in 1922, the subject of the sex hormones was presented for special support because but little was then known concerning hormones in general or the sex hormones in particular. This subject later became a major part of the committee's program. With the large expansion of the field of endocrinology, however, the committee has turned its resources to the neuro-physiological and psychobiological problems of sex under the policy of applying its resources to the less well-developed aspects of the general subject rather than to those in which strong momentum has been acquired. Moreover, the support of a number of investigations initiated by the committee has been taken over by other agencies, giving the committee latitude for the development of new projects. The committee is able to give support to the work of fifteen or twenty collaborators annually, who are located at strong centers about the country for physiological and psychological research.

ENDOCRINOLOGY

A program similar to that for research in problems of sex was set up last year for research in the general field of endocrinology, with attention to the more general metabolic processes, and the relationships of endocrine secretions to aging and to tumorous growths and other hormonal influences. The program is carried on with the cooperation of over twenty-five collaborators in various institutions. It was selected for support by the John and Mary R. Markle Foundation, after careful study of many opportunities, as one of the most useful fields of science to which the Foundation might give aid.

NARCOTICS RESEARCH

The Committee on Drug Addiction, which is concerned with investigations upon the chemistry and

pharmacology of narcotic drugs, supported by the Rockefeller Foundation, has prepared a résumé of its work during the past seven years. The committee has an interesting record of exploration into an unknown field, involving the setting up of research establishments competent to deal with the several aspects of the total problem; the contribution of much new knowledge upon the chemistry and pharmacology of narcotic alkaloids; the development of a large number of new alkaloid substances and the determination of their properties; the testing of the clinical characteristics of certain of the more promising of these substances; the devising of channels for the control of these products in the United States and abroad by taking advantage, under new relationships, of the existing patent laws and other facilities; and effecting the cooperation of a large number of individual scientists and physicians and of different types of agencies, educational, industrial and governmental. The report upon the work of this committee will be published this winter as Supplement 138, of the Public Health Reports.

RADIATION RESEARCH

The program for the study of the biological effects of various types of physical radiation, which the Council has sponsored for the past eight years, is to be continued during the current year. These investigations have been supported by funds provided by the Rockefeller Foundation and by the loan or donation of apparatus and materials by manufacturing concerns. Some twenty-seven investigators are now collaborating in this program, located at twenty-four institutions.

In the early years of this project the grants assigned were in the fields of cytology, genetics and growth and development. In more recent years emphasis in the program has been placed upon quantitative studies and on the mechanism of the effects of radiation. Due to the generous provision of apparatus and materials by manufacturers, it has not been necessary for the Council's Committee on Radiation to allot more than a small proportion of its grants in any one year for the development of apparatus.

Among the problems in this field the mechanism of photosynthesis is perhaps attracting the greatest attention. Other problems on the horizon relate to the influence of radiation as a factor of association upon the hormones of green plants, to the photochemical effects of polarized light, the effects of simultaneous or successive exposure to different wave-lengths of light, and the use of radioactive salts as tracer substances in studies of metabolism. In the development of apparatus the availability of high electric voltages

and of fast neutrons are important contributions for biological experimentation.

AEROBIOLOGY

During the past year the Council's Division of Biology and Agriculture has aided in the development of studies of aerobiology, directed particularly to the occurrence in the upper air of microorganisms, bacteria, viruses, pollen, plant spores and other organic as well as inorganic dusts, and the transportation of these minute particles with air movements. The subject relates not only to the distribution of human, plant and animal diseases, such as the hay fevers and certain wide-spread infections of field crops, but also to the spread of the fungi of industry, both useful and harmful varieties, to problems of economic entomology and of plant breeding and various aspects of plant and animal dispersion. Not of least importance among the applications of knowledge of the biology of the upper air is the utilization of air-borne substance as indicators of air movements.

The project was particularly the creation of Mr. Fred C. Meier, of the U. S. Department of Agriculture. The convincing unfolding of the possibilities for valuable investigations in this newly recognized field, made accessible only comparatively recently by the airplane, was due to Mr. Meier's penetrating vision and courageous enthusiasm. The work commanded the strong interest of the Carnegie Corporation of New York and of the Department of Agriculture, both of which engaged jointly in support of an exploratory program. It is with the deepest regret that record is made of the untimely death of Mr. Meier, and of his colleague in these studies, Dean E. B. McKinley, of the George Washington University Medical School, with the unfortunate loss of the Hawaii Clipper between Guam and Manila on July 29 last, on a journey undertaken in the interests of this project. The loss of these leaders is a heavy sacrifice to science and a very great set-back to the development of a program of research upon this important subject.

JOURNAL OF PSYCHOSOMATIC MEDICINE

Among the subjects for research emerging from the series of conferences which were held last year upon borderland problems in the life sciences were the cause of neuroses in human beings and the influence of these disturbances on behavior of the individual and of groups. A favorable approach to this field of research seems to lie through the study of experimentally produced neuroses in animals, and a committee has been appointed by the Council to develop and coordinate investigation in this field. A number of groups of problems of human neuroses can be recognized, re-

lating to the neuropathological effects of drugs, to the influence of hormones and hormonal sex factors, to early trends of personality in children, frustration studies and conclusions to be derived from psychoanalysis.

In order to provide an outlet for contributions in the field of experimental psychology dealing with neuroses and psychiatry, this committee is establishing a quarterly journal to be called *Psychosomatic Medicine*, the first issue of which is scheduled to appear in January, 1939. The journal is to be supported in its initial stages by a grant from the Josiah Macy, Jr. Foundation. It is the purpose of the journal "to bring together studies which will contribute to the understanding of the organism as a whole in both somatic and psychological aspects." The journal will be in charge of an editorial board representing psychology (in general), neurology, psychiatry, psychoanalysis, comparative physiology, internal medicine and pediatrics, and its scope will comprise these and related fields.

INTERNATIONAL SCIENTIFIC CONGRESSES

The National Research Council appointed representatives for the following international scientific congresses this year:

XIIIth Conference of the International Union of Chemistry, and the Xth International Congress of Pure and Applied Chemistry, Rome, May 15-21, 1938; 15 representatives.

XVth International Geographical Congress, and the 6th General Assembly of the International Geographical Union, Amsterdam, July 18-28, 1938; 7 representatives.

VIth General Assembly of the International Astronomical Union, Stockholm, August 3-10, 1938; 6 representatives.

VIth General Assembly of the International Scientific Radio Union, Venice, September 5-25, 1938; 5 representatives.

In addition a considerable number of other American scientists attended these meetings.

PUBLICATIONS

Among publications of the Council during the year may be mentioned:

An "International Directory of Anthropologists," which lists about 1,950 names, of whom some 600 are from the United States (mimeographed).

A treatise upon "Measurement of Radiant Energy" and a "Glossary of Physical Terms," sponsored by the Council and published commercially by the authors in the latter part of 1937.

"An Experimental Study of the Problem of Mitogenetic Radiation," issued under auspices of the Committee on Radiation. (N.R.C. *Bulletin* No. 100; July, 1937.)

The preparation of the third edition of the "Handbook of Scientific and Technical Societies of the United States and Canada," the Canadian section having been compiled by the Canadian National Research Council. (N.R.C. *Bulletin* No. 101; October, 1937.)

The "Third Report of the Committee on Photochemistry," critically summarizing contributions in this field during the seven years since the issuing of the Second Report of this Committee. (Published in the *Journal of Physical Chemistry*, Vol. 42, pages 699-854, June, 1938; and in the N.R.C. *Reprint and Circular Series*, No. 108, July, 1938).

ROSS G. HARRISON,
Chairman
ALBERT L. BARROWS,
Executive Secretary

SPECIAL ARTICLES

ANTI-CATALASE AND THE MECHANISM OF SULFANILAMIDE ACTION

HEALTHY, normal rabbits fed sulfanilamide in adequate dosage survive intradermal infection with type I pneumococcus in greater number than rabbits not so benefited.¹ Blood taken from the rabbit during the period of conferred increase in capacity for resistance has a comparably increased capacity for retarding proliferation of type I pneumococcus *in vitro*.² The increase is, possibly, accomplished in an indirect way: the actual checking agent being, not sulfanilamide itself, but hydrogen peroxide.

¹ A. Locke, R. B. Locke, R. J. Bragdon and R. R. Mellon, *SCIENCE*, 86: 228, 1937.

² A. Locke, E. R. Main and R. R. Mellon, *in preparation*.

The pneumococcus and the hemolytic streptococcus have the property of being able to produce peroxide without, at the same time, being able to prevent peroxide accumulation.³ Both are sensitive to peroxide injury and depend for peroxide elimination on catalase borrowed from the medium supporting growth. Catalases decompose peroxide and permit growth so long as they remain efficient. They are inactivated by hydroxylamine⁴ and by substances related to hydroxylamine in structure or properties.^{5,6}

³ J. W. McLeod and J. Gordon, *Jour. Path. Bact.*, 26: 326, 1923.

⁴ H. Blaschko, *Biochem. Jour.*, 29: 2302, 1935.

⁵ D. Keilin and E. F. Hartree, *Nature*, 134: 933, 1934.

⁶ M. G. Sevag and L. Maiweg, *Biochem. Ztschr.*, 288: 41, 1936.

Substances analogous to hydroxylamine in anti-catalase effect are produced from sulfanilamide when dilute solutions of the drug are exposed to ultraviolet radiation.² They should be as easily produced from sulfanilamide by peroxide-producing pneumo- and strepto-cocci, through equivalent processes of oxidative disintegration, producing an amount of anti-catalase, within the multiplying organisms, sufficient to permit accumulation of hydrogen peroxide to levels forcing change in growth rate or growth character.

The retarding effect of sulfanilamide on pneumococcal and streptococcal proliferation is not manifested until after a lag⁷ possibly required for the preliminary period of absorption and oxidation, and subsequent hydrogen peroxide accumulation, above postulated. Blockade of the p-amino group, in sulfanilamide, through acetylation, produces a degree of impairment in effectiveness⁸ parallel to the degree of impairment in susceptibility to oxidation effected. Oxidation of the p-amino group to a p-hydroxylamino grouping is reported to produce an increase in ability to check streptococcal proliferation *in vitro* not elicited following more drastic oxidation to the p-nitroso or p-nitro grouping.⁹

The effectiveness of sulfanilamide for producing retardation of streptococcal proliferation, *in vitro*, is increased following dilution of the growth medium with saline,⁸ to an extent paralleling the diminution in catalase concentration produced. Sulfanilamide has appeared to be appreciably more effective, *in vivo*, in accomplishing sterilization of the catalase-poor spinal fluid than in accomplishing sterilization of the catalase-laden blood.⁸

A more detailed presentation of the above-covered material has been prepared for later publication as a part of a comprehensive report on non-specific factors in resistance which may escape notice of investigators interested more directly in the mechanism of sulfanilamide action.

ARTHUR LOCKE
E. R. MAIN
R. R. MELLON

INSTITUTE OF PATHOLOGY,
THE WESTERN PENNSYLVANIA HOSPITAL,
PITTSBURGH

THE EFFECT OF AMMONOLYZED FOODS ON THE GROWTH OF ALBINO RATS

It has been reported recently that calves can gain weight on forms of nitrogen not supposed hitherto to

be digestible and assimilable by animals.¹ Much work of this kind extending back to 1919 has been done in the United States and in Germany, and it has been described in a recent review which contains an excellent bibliography.²

We have modified and extended such work by using albino rats instead of ruminant animals and by using liquid ammonia in place of nitrogen containing salts, although ammonium hydroxide, ammonium carbonate and ammonium citrate were used in some of the control experiments. A preliminary report concerning some of the work has been published.³

It had been shown previously that proteins are ammonolyzed in liquid ammonia, and thereby increase their nitrogen content.⁴ Preliminary experiments showed that ammonolyzed casein caused a loss of weight in young rats when it was used to replace other proteins. In order to determine the cause of this toxic effect, a series of experimental feedings was made in which different constituents of the diet were treated with liquid ammonia or ammonium hydroxide or all the constituents of the diet were mixed with ammonium carbonate. It was found that failure to grow occurred in all cases in which the vitamin B complex in the form of dry yeast was allowed to come in contact with ammonia. However, if the yeast was supplied in a separate container, and the remaining food ammonolyzed, the rats not only showed no such interference with growth, but actually grew more rapidly than control animals on normal diets. The control and experimental animals were given their food *ad libitum*, except for the yeast, and ate equal amounts. The yeast when fed in separate containers was weighed each day, since it is known that vitamin B in excess will accelerate the growth of young rats. Litter mates were used with an equal distribution of males and females. The nitrogen content of the protein was increased by 2.2 per cent. by the treatment with liquid ammonia. In addition it was found that ammonolyzed food has less tendency to spoil or become mouldy than untreated foods.

Just how an albino rat can use such nitrogenous materials as food we are not prepared to say. An explanation in this case might be even more difficult than with ruminant animals, since in their case some intermediate action of bacteria is sometimes assumed.

RICHARD G. ROBERTS
HERMAN J. HORVITZ

DEPARTMENT OF PHYSIOLOGICAL CHEMISTRY,
CHICAGO MEDICAL SCHOOL

⁷ H. Finklestone-Sayliss, C. G. Paine and L. B. Patrick, *Lancet* (2): 792, 1937.

⁸ R. R. Mellon, P. Gross and F. B. Cooper, "Sulfanilamide Therapy of Bacterial Infections," C. C. Thomas, Baltimore, 1938.

⁹ R. L. Mayer and C. Oechslein, *Compt. rend.*, 205: 181, 1937.

¹ E. B. Hart, H. J. Deobald and G. Bohstadt, *SCIENCE*, 88: Supplement, 10, 1938.

² J. F. T. Berliner, *Chemical Industries*, March, 1936.

³ R. G. Roberts and H. J. Horvitz, *Jour. Biol. Chem.*, 123: Proc. XXXII cii, 1938.

⁴ R. G. Roberts and C. O. Miller, *Jour. Am. Chem. Soc.*, 58: 309, 1936.

VITAMIN B₁ AND THE GERMINATION OF POLLEN

BEGINNING with the work of Von Mohl¹ in 1838, varying degrees of success have attended attempts to cultivate pollen *in vitro*. The culture media in most cases consisted of a mixture of sugar and agar or sugar and gelatine. A very considerable improvement in these culture media was effected by Brink,² who discovered that a water extract of sterile yeast added in small amounts to the sugar media stimulated pollen tube germination.

In recent years it has been found³ that the beneficial effects of yeast extracts on the growth of excised roots *in vitro* was due in part, at least, to the vitamin B₁ content of the yeast extract. This consideration has led the writers to suspect that vitamin B₁ might be the substance in yeast extract that produced the beneficial effects observed by Brink. That this vitamin does actually accelerate germination of pollen is shown in the following experiments.

Pollen from *Carica quercifolia* and from the Orlando, Fairchild and Florida varieties of *Carica papaya* was tested for germination percentage in Van Tiegham cells, using a medium of 4 per cent. sucrose and $\frac{1}{4}$ per cent. agar with and without the addition of crystalline vitamin B₁ (0.1–200 gamma per cc). With the exception of the Orlando variety, an addition of 100 gamma B₁ per cc resulted in a significant increase in the germination percentage over that obtained without B₁ (Table 1). This increase was, however, in most in-

TABLE 1
GERMINATION OF PAPAYA POLLEN WITH AND WITHOUT
TREATMENT WITH VITAMIN B₁

Variety	Length of test period Hrs.	Control Per cent. germination	Vitamin B ₁ * Per cent. germination	Percentage difference over controls
<i>C. quercifolia</i>	1	10	21	+ 110.0
	1½	25	37	+ 48.0
	2½	31	56	+ 80.6
	4½	71	80	+ 12.6
Fairchild	1	53	67	+ 26.4
	2½	67	77	+ 14.9
	4	75	88	+ 17.3
Florida	1	25	41	+ 64.0
	2	46	80	+ 73.9
	5	85	86	+ 1.1
Orlando	½	35	32	+ 8.5
	1½	76	75	- 1.3
	2½	80	77	- 3.7

* 100 gamma per cc.

stances greater during the first two hours than after a four-hour period, which suggests that the main effect of the B₁ treatment was to speed up germination. A

¹ H. Von Mohl, *Beitrage zur Anatomie und Physiologie*. I. Bern. 1834.

² R. A. Brink, *Am. Jour. Bot.*, II: 283–294, 1924.

³ J. Bonner, *SCIENCE*, 85: 183, 1937; W. Robbins and M. Bartley, *SCIENCE*, 85: 246, 1937.

survey of the effectiveness of various concentrations of B₁ on the germination of pollen of the Florida variety showed that a maximum response was attained with 100 gamma per cc. Some acceleration in germination over controls was obtained from 50 gamma, but 0.1, 1 and 10 gamma gave no response. This effect from such high concentrations of B₁ is interesting in view of the fact that the optimum B₁ concentration for root growth has been found to be near 0.002 gamma per cc.³

Vitamin B₁ has been detected by biological assay in leaves, stems, roots, fruits and seed of many plants (Summary in Sherman and Smith.⁴) Also Dutcher⁵ has demonstrated the presence of vitamin B in maize pollen. It may be that germination of pollen taking place without the addition of an external supply of B₁ is caused by naturally occurring vitamin B₁ in the pollen. Further work on the physiology of vitamin B₁ and other substances in pollen germination is under way. Addition of indoleacetic acid in concentration ranging from 1/10 to 100 gamma per cc had no beneficial effect on germination of papaya pollen.

WALTER B. DANDLIKER
WILLIAM C. COOPER
HAMILTON P. TRAUB

BUREAU OF PLANT INDUSTRY,
U. S. DEPARTMENT OF AGRICULTURE,
ORLANDO, FLORIDA

⁴ H. Sherman and S. Smith, "Vitamins." Chemical Catalog Company, N. Y., 1931.

⁵ R. A. Dutcher, *Jour. Biol. Chem.*, 36: 551–555, 1918.

BOOKS RECEIVED

- GEORGE, WILLIAM H. *The Scientist in Action; A Scientific Study of his Methods*. Pp. 354. 31 figures. Emerson Books, New York. \$3.00.
- HARDY, G. H. and E. M. WRIGHT. *An Introduction to the Theory of Numbers*. Pp. xvi + 403. Oxford University Press. \$8.00.
- KERMACK, W. O. and P. EGGLETON. *The Stuff We're Made of*. Pp. vii + 342. 8 plates. 55 figures. Longmans, Green. \$3.20.
- Nutrition: The Newer Diagnostic Methods; Proceedings of the Round Table on Nutrition and Public Health*. Sixteenth Annual Conference, March, 1938. Pp. 192. Milbank Memorial Fund, New York.
- REEDY, J. H. *Theoretical Qualitative Analysis*. Pp. ix + 451. 34 figures. McGraw-Hill. \$3.00.
- RILEY, J. H. *Birds from Siam and the Malay Peninsula in the United States National Museum Collected by Drs. Hugh M. Smith and William L. Abbott*. Smithsonian Institution Bulletin 172. Pp. iv + 581. Superintendent of Documents, Washington. \$0.75.
- Seventy-five Years; A History of The Buffalo Society of Natural Sciences, 1861–1936*; Vol. XVIII of the Bulletin, 1938. Pp. 204. Illustrated. The Society, Buffalo.
- SLICHTER, CHARLES S. *Science in a Tavern; Essays and Diversions on Science in the Making*. Pp. ix + 186. University of Wisconsin Press.
- Studies of the Institutum Divi Thomae, Vol. II, No. 1, November, 1938*. Pp. vi + 153. Illustrated. The Athenaeum of Ohio, Cincinnati.
- TICEHURST, CLAUD B. *A Systematic Review of the Genus Phylloscopus (Willow-Warblers or Leaf-Warblers)*. Pp. viii + 193. 2 plates. British Museum, London. 10/.

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The experiments described in this new manual have been selected primarily to meet the interests of students who are taking physiology for the first time. The experiments are not too difficult, but significant.

Desha and Farinholt—EXPERIMENTS IN ORGANIC CHEMISTRY

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This book is designed to provide a program of laboratory work closely correlated with Professor Desha's well-known textbook *Organic Chemistry*. The manual contains most of the standard preparations, together with numerous tests and small-scale experiments illustrating a wide variety of reactions and principles.

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SCIENCE NEWS

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RADIO TRANSMISSION

A NEW method of radio transmission and reception which should have important application in airplane radio and international broadcasting was reported to the recent meeting of the Institute of Radio Engineers by Murray G. Crosby, engineer of the Radio Corporation of America.

The new system, known technically as phase modulation, enables a transmitter to broadcast four times as efficiently as those in present use. This fourfold power output with present equipment can be used either to get stronger signals at a distance—as in international broadcasts—or to get signals of present strength with less cumbersome and heavy equipment. This last is the significance of the new advance for aviation communication. It is not believed that the new advance in the radio art will affect standard broadcasting since most effective reception requires specially built receivers. These would not need be much more expensive than present types, but the total cost and inconvenience of a mass change-over would militate against such a change.

The system of phase modulation is essentially different from the existing method in which amplitude modulation of the signal is employed. In amplitude modulation the voice or other sound on the radio wave increases or decreases the strength of the signal in accordance with the undulations of the sound that it carries. In the new phase modulation system, the radio signal is always of constant, maximum strength. The variation, or modulation, of the new waves is accomplished by shifting the electrical oscillations so that they precede or lag in their normal frequency of occurrence. The varied signal is thus a bit out of phase, and hence the term phase modulation for the method. Mr. Crosby pointed out that phase modulation is itself no new thing but it has taken ten years of laboratory research to obtain a practical method of generating and utilizing the waves to the best advantage.

VITAMIN B₁ INJECTIONS IN ACUTE NEURITIS OF LEPERS

RELIEF from the pain of neuritis, which accompanies some cases of leprosy, has been achieved through studies made by members of the U. S. Public Health Service at its Honolulu station. Drs. L. F. Badger and D. W. Patrick, of the Leprosy Investigations Division in *Public Health Reports*, indicate that injections into the muscles of solutions of vitamin B₁ produce relief from pain.

Lepers with acute neuritis were sometimes in such pain that it was almost impossible for the physicians to make an adequate examination of the swollen nerves because the patients could not permit their bodies to be touched. Such victims were given relief in some cases within 24 hours. And in all but one patient relief came within three or four days.

In the tests at the leper colony in Hawaii the physicians used 59 patients split into four groups. One group received vitamin B₁ by drinking pineapple juice containing

brewer's yeast, which has a relatively high content of the vitamin. Another group took their vitamin B₁ in concentrated form by mouth. A third received the concentrate by intra-muscular injection. The fourth group served as a control and did not receive special doses of the vitamin.

While the number of patients receiving the injections were small (only 10) the results were amazing. It is planned to continue the study on a much larger group of cases. A discussion of the results reads: "The results obtained in the few cases of acute leprosy neuritis reported strongly suggest that material benefit is derived from intramuscular injections of vitamin B₁. Experience also suggests that similar results are not obtained by oral administration of that vitamin. No improvement was noted following administration, for over a 6-month period, either of large doses of brewer's yeast or of vitamin B₁ concentrate. On the contrary, acute neuritis developed after the vitamin B₁ concentrate was given (by mouth), in one case for 6 months and another for 8 months."

Comparison of the new injection treatment with other methods used in the past, shows a marked decrease in the time needed for relief. One patient in the test had previously had an attack of acute neuritis which persisted for 24 days when treated by former methods. In a new and severe attack, the injections stopped pain after three days and tenderness after four days.

THE BENEFITS OF AIR CONDITIONING

THE benefits of air conditioning in office buildings in summer continue after the workers leave their desks, it was shown in studies reported at the recent meetings of the American Society of Heating and Ventilating Engineers.

Reporting on reactions of 274 office workers to air conditioning, and whether they withstood the heat better than their less fortunate friends who worked without benefit of air conditioning, F. C. Houghton, A. B. Newton, R. W. Qualley and Edward Witkowski showed that over 72 per cent. withstood hot weather better than if they had not enjoyed air conditioned comfort during their working hours. Fifteen per cent. of the replies reported no difference, while about 13 per cent. said that they did not withstand the evening heat as well as those who had had to work, all day, in heat and humidity. Asked whether they noted a definite feeling of the warmth immediately after leaving their air-cooled office, over 35 per cent. said they noted no difference. Thirty-five per cent. said they had a feeling of warmth. Twenty-two per cent. added that this hot feeling lasted less than 20 minutes, 6.6 per cent. said it lasted less than an hour and 6.6 per cent. felt it for a few hours. Over 12 per cent. noted this warm feeling all night. Some 17 per cent. gave no intelligent answer to this question. The votes showed about a two to one ratio for benefits versus dislike for air conditioning. Sixty-six per cent. replied favorably with some 34 per cent. of these replying that it was more comfortable and

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NEW BOOK AND INSTRUMENT CATALOGUES

BAUSCH AND LOMB OPTICAL COMPANY, Rochester. *The Educational Focus; Vol. IX, No. 2, Spring, 1938.* Pp. 24. Illustrated. *Bausch and Lomb Magazine.* Pp. 24. Illustrated.

CHICAGO WHEEL & MANUFACTURING COMPANY, Chicago. *Handee Tool of 1001 Uses.* Pp. 32. Illustrated.

E. I. DU PONT DE NEMOURS AND COMPANY, INCORPORATED, Wilmington. *The Neoprene Notebook, May, 1938.* Pp. 9-12. Illustrated.

OXFORD UNIVERSITY PRESS, New York. *Bulletin of New Publications, April and May, 1938.* Pp. 16. Illustrated.

QUARITCH, BERNARD, LIMITED, London. *A Selection of Interesting Books on a Great Variety of Subjects; No. 550, 1938.* Pp. 160. Illustrated.

STOKES, THE F. J., MACHINE COMPANY, Philadelphia. *Stokes High Vacuum Pumps; Catalog No. 38-P.* Pp. 28. Illustrated.

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pleasant. Another 27 per cent. thought they worked more efficiently, while 3.6 per cent. reported "more pep." About one per cent. reported that they had fewer colds. From the 31.7 per cent. replying adversely, 19.2 per cent. said they were too cool and that at times it was drafty. Four per cent. stated that they were too warm. Reports that it was too stuffy and too humid totaled 2.7 per cent. each, while 3.1 per cent. reported that they contracted colds.

The engineers, who represent the society's research laboratory in Pittsburgh and the Minneapolis-Honeywell Regulator Co., believe that the questionnaire serves a useful purpose in indicating a large percentage of general satisfaction to air conditioning and the lack of severity and importance of the hot reaction upon leaving the air conditioned space. It is logical that this should be the case, since it is generally recognized that the unsatisfactory reaction of the human body to an extended hot spell is a cumulative effect.

THE DEAF CHILD

THE newest ways of helping deaf children were discussed at the Detroit meeting of the American Association to Promote the Teaching of Speech to the Deaf. It was stated that it is far less tragic for a child to have defective hearing now than a generation or two ago. So much more can be done. Statistics show that 1,600,000 children in the United States, or six out of 100 of school age, have defective hearing. Of these, 300,000 are seriously enough affected to need help by reading a speaker's lips.

Under discussion at the conference was an invention from South Africa, which an engineer has devised to teach deaf children to talk naturally, instead of in a dull monotone. The invention, used successfully in South African schools for the deaf, looks like a box. At one side is a vertical string of fourteen light bulbs, gay colors. On the front of the box is a green blackboard. The teacher writes "Good morning" on the board, and draws a curve to show how the voice should rise and fall. The deaf child says, "Good morning," and the colored lights flash to show the pitch of his voice. Electro-magnetically operated tuning forks operate the device. The top four and bottom two lights are red, meaning danger—voice too high and shrill, or too low and gruff. The inventor of the device is A. E. Coyne, instructor in engineering at the Cape Technical College. The invention is mainly for the totally deaf child, who has no way of hearing his own speech defects.

Helping the child to "hear" by feeling the vibrating bones of a speaker's head is another recent development which was discussed, and demonstrated. At the Detroit Day School for the Deaf all incoming classes are taught to feel speech. Children who have little or no hearing, can not get help from mechanical devices. They can, however, learn to "hear" what a speaker says by casually placing a hand almost anywhere against the speaker's cheek or on his head.

Efforts to salvage what hearing the deaf or hard-of-hearing child may have was another topic of the conference. It is now realized that the hearing of many a child

who seems totally deaf can be trained and improved, whereas, if neglected, the child does in truth become deaf.

Notable improvement in instruments to aid hearing is arousing much interest. There is prospect that such instruments in general use will attain the efficiency of eyeglasses, enabling those who can be helped by an instrument to hear clearly and easily.

PAPERS READ BEFORE THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

RAPID growth of farm electrification was predicted by speakers before the meeting of the American Society of Agricultural Engineers held recently in Pacific Grove, Calif. Less than a fourth of the farms able to use electricity are actually using it now. The barrage of sales effort that has been in effect during the past few years is proving beneficial to all concerned, in the opinion of E. G. Stahl, of the San Joaquin Light and Power Corporation. "Unquestionably," he stated, "the large volume of propaganda put out by the Rural Electrification Administration has lessened sales resistance, which has materially benefited the private utilities in their rural service expansion program." The extent of private power companies' activity in the rural areas is indicated by the servicing of approximately 300,000 rural homes by private companies during the two years ending December 31, 1937, while the R. E. A. installations amounted to only about 33,000. Mr. Stahl expressed the hope that public and private interests will cooperate more closely, for future benefits to the consumer. Possibilities for further expansion were emphasized by George A. Riets, head of the rural electrification section of the General Electric Company. He pointed out that although electrified farms have increased in number from 200,000 in 1926 to more than 1,250,000, there are still 5,250,000 American farms that have not been electrified.

MANIFOLD uses for electricity on the farm were discussed by other speakers. Electrically operated pumps deliver millions of gallons of water every minute to California's irrigated fields and orchards, and electric irrigation is taking hold even in the East and Midwest. Paul Ford, of the Pacific Gas and Electric Company, told of a huge outdoor brooder on a turkey farm, where 4,000 feet of soil-heating cable, buried in sand, "mothers" 9,000 turkey chicks at a time. Thus far this year, 26,000 turkeys and several thousand chickens have been raised in this brooder. E. M. Mrak, of the University of California, described the systems now in use in the leading dehydration plants in California. Electricity is used both for heating the fruits and for driving currents of air over them to carry away the moisture.

A NEW type of cotton picking machine was described by E. A. Johnston, vice-president of the International Harvester Company. The new machine has two revolving cylinders, each bearing 154 spindles. Unlike the much-discussed Rust cotton picker, the new International machine has tiny barbs on its spindles. As they whirl, the barbs catch the cotton fibers and pull the ripe bolls

out. The spindles then pass devices called "doffers" which take the cotton off them and drop it on a conveyor belt. Machine harvesting of cotton may bring changes all along the line in the cotton-growing industry, Mr. Johnston pointed out. The very shape of the cotton plant itself may be changed by breeding, to permit readier operation of the mechanism. Probably no picking machine will be built in the immediate future that will pick cotton as cleanly as human fingers do, but this is true of all kinds of harvesting machinery. Just as grain-handling machinery has been evolved to take care of the "mistakes" of reapers, so future developments in gins and cotton-cleaning machines may be expected to be adapted to new factors introduced into the industry by mechanical cotton pickers.

FIELDS rebuilt into terraces by powerful earth-moving machinery will yield the better crops of cotton demanded by the steel-fingered pickers of the future. Eugene C. Buie, of the U. S. Soil Conservation Service, reported solid profits obtained by terracing farm lands on the Southern High Plains. Experimental data indicate that the available soil moisture which can be utilized for plant growth may be increased as much as 50 per cent. as a result of level terracing with contour tillage. This increased available moisture has shown an average increased production of lint cotton for an eleven-year period sufficient to pay the initial cost of land at \$50 an acre, the cost of the terracing, and still have money left over for dividends. Level terraces on wheat land with less than a one per cent. slope have shown an increased net income above the cost of terrace construction of \$1.75 per acre for a ten-year period and on grain sorghums an average of \$838.40 per section increased income as a result of one year's observation over approximately 5,000 acres."

PALE blue light proves a fatal lure to the grape leafhoppers, a serious pest in vineyards, as reported by J. K. Ellsworth, of the University of California. Females of the species responded most readily to the light. Counts of large sample catches showed 88 per cent. female insects. Many light colors were experimented with, before the attractiveness of pale blue was discovered. Other colors attract other insects. The lights have also been used as an easy means for obtaining insects to feed to laboratory animals. The lights lure the flying victims. When they arrive at their goal, they fly against high-tension wires that kill them instantly.

ITEMS

THE Connecticut Experiment Station has announced that the Mexican bean beetle can now be combated with sprays that kill the insects without leaving poisonous residues dangerous to man. The sprays are based on derris, pyrethrum, and other plant products that have been successfully used against flies, mosquitoes, and other types of insects, but have not hitherto been employed in the bean beetle fight.

ISLAND authorities at the British Mediterranean naval base at Malta have turned to systematic pasteurization of goat's milk in an effort to wipe out Malta fever. One pasteurized goat's milk distribution center has already

been opened at Hamrun, two miles from Valetta, the main town. Distribution methods similar to those used for cow's milk are to be used. Malta or Mediterranean fever is caused by a germ transmitted by unsanitary goat's milk. Prohibition of the import of Malta goats into Gibraltar years ago wiped out the disease in the latter British station and its elimination from the diet of troops and sailors stationed at Malta has wiped out the disease among the island's military personnel.

GARNET and tourmaline, staurolite and zircon, and a host of other heavier-than-average semi-precious stones now have a new use—telling the age of mountains. In the Big Horn Basin in Wyoming, Dr. Marcellus H. Stow, geologist, of Washington and Lee University, is tracing the source of the ancient sediments back to the still more ancient mountains from which they came. Piled one over the other, with the youngest on top and the oldest below, the Cretaceous and Eocene sediments of the area were derived from the wearing away of the highest of the ancient Rocky Mountains. Thus, the Hell Creek beds contain abundant zircon in all samples, suggesting their origin from a zircon-containing mountain. They contain no hornblende, showing that the source of the sediments was hornblende-free. Further studies show that the Hell Creek beds were derived from the erosion of sediments. Each bed of the series present in the Big Horn Basin was likewise studied for heavy minerals, and its probable source determined. From this, Dr. Stow hopes to determine which areas were "up" during each phase of the Laramide period of mountain-building, 90,000,000 years ago, more or less.

SEEKING to cut down the rate of wear on steam turbine blades, which rotate at high speed under the impact of a steam jet, engineers of the Westinghouse Electric and Manufacturing Company have been subjecting bits of metal to an erosion test that duplicates in a few minutes the wear of years. Under R. E. Peterson, manager of the mechanics division, engineers have been directing a stream of water at the same pressure as water running from a kitchen tap against bits of metal whirling at a speed of 13 miles a minute. Three minutes of such treatment cuts a deep, jagged notch into the metal, an effect a dripping faucet might take years to duplicate. The study is a part of a research program aimed at strengthening metals by analyzing their wearing and fatigue characteristics.

A RADIO CLOCK, built either as an auxiliary or as an integral part of an otherwise ordinary radio receiver, has been patented. Designed by Walter van Braam Roberts, of Princeton, the device as described tells time to the nearest five minutes, but can be modified to tell time to the nearest minute and second. Controlled by a master clock at the radio station, signals are sent out at the selected interval. The signals consist of low frequency modulations, below the range audible to the human ear. Received by the receiver at the same time the regular program is coming in, the signals cause reeds to vibrate. The reeds in turn permit to pass or do not permit to pass a beam of light directed toward a screen. The position of the light beam indicates the time. The patent has been assigned to the Radio Corporation of America.

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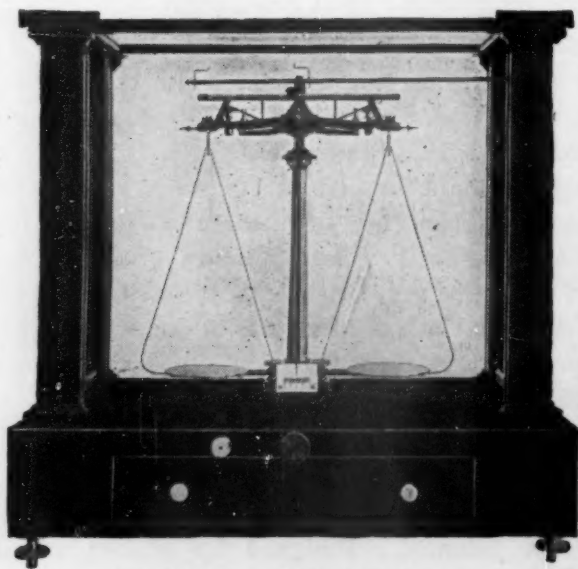
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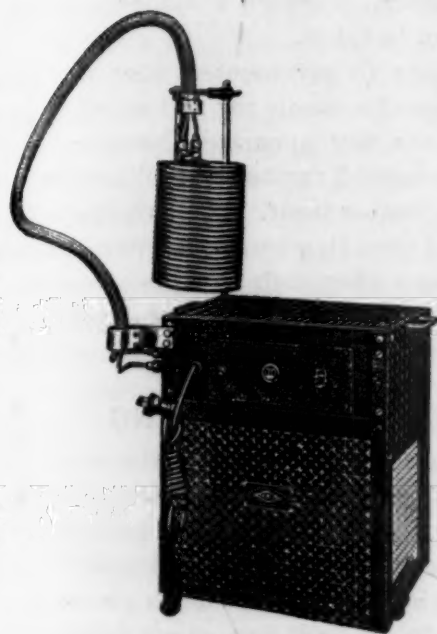
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SCIENCE NEWS

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THE CHICAGO SYMPOSIUM ON COSMIC RAYS

At the Symposium on Cosmic Rays, sponsored by the University of Chicago, Dr. Arthur H. Compton, professor of physics at the university, suggested that new findings in cosmic ray research are best interpreted if the origin of the mysterious rays is "local," in the galaxy of stars containing the Milky Way, the sun and the earth. Previously, Dr. Compton had tentatively suggested that cosmic rays came from the remote regions of interstellar space, far beyond the confines of our galaxy. He stated that the new theory is also tentative, but that it seems best to fit the new observations. It throws some doubts on the exploding universe theory of the origin of cosmic rays which has been advanced by Abbe G. Lemaitre, and which has found considerable acceptance among physicists. The basis for the changed viewpoint of the origin of cosmic rays was the failure to find any evidence of the so-called "galactic effect" in the rays' intensity. It has been previously suggested that there should be a variation of the cosmic radiation, throughout the day, if the rays originated beyond the Milky Way. According to theory, there should be more rays received in the northern hemisphere than in the southern, because the northern hemisphere would be the forward moving side of the earth, in the rotation of the galaxy. The situation would be like a person riding on a merry-go-round in the rain, who would be hit by more rain drops in the face than in the back.

Professor M. S. Vallarta, of the Massachusetts Institute of Technology, described his calculations of this "galactic rotation" effect and its magnitude, if it existed. Observations made throughout the world, Dr. Compton said, have failed to find an effect even a tenth as large. These observations have forced the conclusion that the cosmic rays therefore originate "locally" within our galaxy. "We should continue to think of the cosmic rays as very old, perhaps dating from the origin of our galaxy itself, perhaps being the accumulation of millions of years of some gradual process giving rise to high energy particles. We should not, however, think of them as coming from space which on an astronomical scale is very remote."

A NEW TRAP FOR COSMIC RAYS

Using a new and novel trap for catching piercing cosmic rays, Dr. Carl D. Anderson and his colleague, Dr. Seth Neddermeyer, of the California Institute of Technology, have obtained a photograph of a powerful cosmic ray particle with 10,000,000 electron-volt energy entering the apparatus and emerging with an energy of only 210,000 electron volts. But the particle actually came to rest within the range of the camera and its stopping is recorded. Measurements indicate it is the so-called heavy electron with a mass some 240 times as great as that of the ordinary electron, basic unit of electricity. Although the photograph, which is printed in *The Physical Review*,

does not actually show it, Drs. Anderson and Neddermeyer suggest that the heavy electron came to rest and then disintegrated into a positive electron with ordinary mass.

The new cosmic ray trap consists of a special form of a device known as a Wilson cloud chamber in which the tracks produced by the speeding cosmic rays are made visible as they serve a nuclei of condensation of water vapor in the chamber. Through a window a photograph of these tracks can be taken.

In the usual plan Geiger counters near this chamber detect the presence of a cosmic ray and set off the camera mechanism. In the new apparatus, however, these detectors are supplemented further by still another counter inside the cloud chamber itself. This arrangement favors the probability of observing cosmic ray particles near the ends of their ranges when their energies are weak. That the device actually photographed a cosmic ray particle as it stopped and came to rest was a fortuitous happening.

HIGHWAY LIGHTING

STUDIES conducted by C. A. B. Halvorson, of the General Electric Company, at Lynn, Mass., indicate that pavements on highways needing permanent lighting will in future be processed to insure a high order of uniform light reflectivity in contrast to to-day's pavements which are highly wasteful of light from street lamps and other sources.

Literally turning light onto a hitherto dark and neglected subject, the experiments emphasize the rôle played by the way in which a street pavement reflects light. The provision of adequate night lighting is believed to be one of the most effective approaches to cutting the mounting toll of night accidents.

Surfacings now in common use "soak up" of waste light in varying degrees, having a light reflectivity from less than four to more than 30 per cent., according to their color character, Mr. Halvorson has found. These surfaces also reflect light differently, some diffusely like snow and some specularly like polished metal. Most roads combine both types of reflection and do not provide uniform reflection which is essential to proper seeing at night.

A problem facing highway lighting engineers is the fact that road surfaces, with but one or two exceptions, change their reflecting characteristics when wet. Wide variation is also found to occur in accordance with the specific intensity, direction and angle of light applied.

Experiments conducted on a model road near Lynn with test objects and test lamps made it clear that vision in highway lighting is primarily accomplished by means of contrasts between objects and pavements.

A special "pavement" represented by truncated conical cups light in color was tried and found to give excellent reflectivity characteristics under conditions representing day and night, rain and shine.

The lighting engineers must look to the paving in

dustry for assistance and research on the problem and to bring the experimental results gained in these studies into practical application.

THE NEW FOOD AND DRUG LAW

WHILE the provisions of the new Food and Drug Act will not, in general, be effective for another year there are three important exceptions which take effect immediately.

From the tragedy caused by the Elixir of Sulfanilamide comes regulation of the introduction of new drugs into interstate commerce. Effective immediately, any person introducing a new drug for sale between states must first file with the Secretary of Agriculture an application which contains complete information on the chemical contents of the drug, the proportions used, any chemical reactions which take place between the drugs, all tests made to determine the usefulness and safety of the drug, and send in five samples. The latter must contain the actual material being submitted for sale and the proposed labels.

From this information the secretary shall act, either to permit sale or prevent sale through a restraining order. If the applicant receives no notice from the Department of Agriculture within 60 days, approval of the sale of the product is automatic. Such regulation over new drugs, it is felt, will prevent a repetition of the sulfanilamide tragedy. While it would not prevent a case like that which caused death by injection of the cancer drug Ensol (because Ensol was being used only experimentally and was not for sale in interstate commerce), such a drug would come under the act immediately it was offered for sale.

Two other provisions of the new act are also effective at once. They are the prohibition of drugs which are dangerous to the consumer when used as prescribed on the label and a prohibition of cosmetics which may be injurious to the users.

Other important changes in the act, which will go into effect a year hence, include:

1. The new law has jurisdiction over all cosmetics except toilet soaps. This means that the American public will be protected against dangerous cosmetics such as eyelash dyes that have been known to cause blindness.
2. Brings therapeutic devices under control. In the past, many curative claims have been made for devices such as electric belts which have no value.
3. Regulates drugs intended for diagnosing illness or for remedying underweight or overweight, or otherwise affecting bodily structure or function. Included in this group are the so-called "slenderizers," many of which have caused blindness and death.
4. Requires adequate testing of new drugs for safety before they are put on the market. The elixir of sulfanilamide which caused the death of nearly 100 persons last year emphasized dramatically the need for this provision.
5. Provides for the promulgation of definitions and standards for foods. The old law contained no such authority except for canned foods. This means that the definitions and standards which under the old law were

not binding, but merely advisory, will now have legal force and effect.

6. Increases penalties for violations. Under the old law the maximum fine for the first offense was \$200. Under the new act a first offense may be punished with a fine of \$1,000 or one year imprisonment or both. For subsequent offenses under the old law the maximum fine was \$300 or one year imprisonment or both. Under the new law this penalty is increased to a maximum of \$10,000 or three years imprisonment or both. Even for first offenses where the court finds evidence of fraud or deliberate intent to violate the act the maximum penalties are \$10,000 fine or three years imprisonment or both.

7. Provides authority for the Federal courts to restrain violations by injunction.

8. Eliminates the necessity for proving fraudulent intent in the labels of patent medicines. Under the new law any such medicine proved to be worthless may be removed from the market.

9. Requires drugs intended for use by man to bear labels warning against habit formation if they contain any of a list of narcotic or hypnotic habit-forming substances, or any derivative of any such substance which possesses the same properties.

10. Requires the labels of non-official drugs (those not listed in the Pharmacopoeias and Formulary) to list the names of the active ingredients, and in addition to show the quantity or proportion of certain specified substances.

ITEMS

THE United States ranks fourth in the number of Nobel Prize winners; it is shown in a survey completed by Professor Harrison Hale, of the University of Arkansas, for the American Chemical Society. Eighteen Americans have been honored with the prize since it was first inaugurated in 1901 under the will of Alfred Nobel, discoverer of dynamite. Germany leads the list of nations with 37 laureates, England comes second with 23.5 and France is third with 20.5. The fractions mean that some years the prize has been split between two men. The Nobel Prize, granted for outstanding achievement in physics, chemistry, medicine, literature and on behalf of international peace, has changed in its award pattern in the last decade. In prizes awarded during the last ten years England and the United States lead with 10 each. Germany comes next with 9.5 and France has dropped behind with only four. During this time the relative position of the United States has improved 63 per cent.

Nature reports that two British investigators, F. C. Rawdon and N. W. Pirie, have succeeded in producing crystalline nucleoproteins from two strains of the potato virus X, the cause of a plant disease. The second virus to be so isolated and crystallized, crystalline nucleoprotein derived from potato virus X is held definite proof of the protein nature of the filterable viruses, the mysterious causes of disease in plants, animals and humans alike. The filterable viruses are so small that they pass through the finest filters and are invisible under the most powerful microscopes. The first one to be successfully

crystallized as a nucleo-protein of high molecular weight was the virus that causes tobacco mosaic, a wide-spread disease of tobacco plants. This was done by Dr. Wendell M. Stanley, of the Rockefeller Institute for Medical Research. It is pointed out that "potato virus X is perhaps more typical of viruses in general than tobacco mosaic, so it seems more probable that all viruses may be specialized nucleo-proteins." Two strains of the potato virus were crystallized, the S and G strains.

GEYSERS in Yellowstone National Park, spectacular enough at all times, appear to be putting on a special show this season. Old Faithful has been spouting to unprecedented heights. Recently an eruption reached the height of 223 feet, which is 73 feet above its 150-foot averages and 32 feet higher than its previous record of 192 feet. Grand Geyser has taken a new lease on life, with 200-foot eruptions at thirty-hour intervals. The Giantess, largest of all geysers, has erupted four times in nine months, which is about double its usual rate. National Park Service observers are not yet certain whether there has been a general increase in geyser activity or simply a shift in underground water flow, increasing the activity of some at the expense of others.

DON'T tidy up forests too much, by removing fallen timber and otherwise clearing the ground, is the advice of a leading Swiss ecologist, Dr. Arnold Pictet. If you clear away all such accumulations of "rubbish" you deprive the forest of much of its biological working capital. Trees are a soil-exhausting crop, Dr. Pictet

points out. They withdraw a large proportion of the soil's original store of nutrient substances and lock it up in their stems. When they fall, the swarming destructive life of the forest floor—insects, worms, fungi, bacteria—unlock these hoards and return the accumulated capital to the soil as humus. Lumbering operations inevitably carry off a good deal of this capital to market. Fire destroys it, not to be replaced for centuries. Fallen trunks, and forest litter generally, can re-invest a part of it in the soil.

AN easily readable device that tells the navigating officer how much a ship is off a pre-determined course has been patented by Francis West, Jr., of Chilmark, Mass. An electrical set-up enables the compass to be kept at one place and to operate an indicator on the bridge to inform bridge officers the ship's direction in terms of the course set, according to the specifications for the patent. It can replace with a simple needle swinging across a dial the complex compass card that requires considerably more than a glance to read it. So long as the ship is correctly headed a needle rests at zero on a dial. A condenser of a particular type is actuated by the compass so that when the ship moves off course a capacity bridge is no longer kept in balance and the bridge-actuated needle swings to one side. Amount of swing informs the navigating officer how much the vessel in his charge is off course. Mr. West claims that the device is suitable for use on ships, airplanes or other means of transportation requiring compass-steering.

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By

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CYCLOTRON TO BE BUILT BY THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

AN atom-smashing cyclotron to be devoted exclusively to medical and biological research, will be constructed at the Massachusetts Institute of Technology during the coming year. The machine will weigh more than a hundred tons and will be of the most approved type and of the same general size as the largest machine yet built, with the exception of the one now under construction by Professor Ernest Lawrence at the University of California.

In announcing plans for the cyclotron, made possible by a grant from the John and Mary R. Markle Foundation of New York, Dr. Karl T. Compton, president of the Massachusetts Institute, said: "The institute is in a fortunate position to undertake this work for two reasons. First, because Professor Robley D. Evans, under whose direction the cyclotron will be built and operated, has developed an unusually successful technique for the detection, measurement and handling of radioactive chemical elements of the type which can be produced in large quantities by a cyclotron. It was for this technique as applied specifically to radium poisoning that he was awarded the Theobald Smith Prize of the American Association for the Advancement of Science a year ago.

"Working up to the present with a relatively very feeble source of radioactive materials, Professor Evans has nevertheless done some very interesting exploratory work regarding the medical possibilities in the use of particular radioactive elements, in collaboration with several members of the Harvard Medical School and local hospitals, and also in collaboration with members of the department of biology and public health at Technology.

"The new cyclotron will permit work of this type to be greatly extended in power and scope and the program may be considered as a joint program between Professor Evans's group of physicists together with biologists at the Massachusetts Institute of Technology and medical research men in neighboring institutions.

"The second fortunate element in the situation at the Massachusetts Institute of Technology is the parallel program of the high voltage electrostatic generator of Professor Van de Graaff, who, with his colleagues, is engaged in a very comprehensive program of atomic physics. This program comprises not only the very important medical x-ray applications, which a cyclotron is inherently unable to handle, but includes also a comprehensive program of investigation in atomic physics which will parallel the investigations which can be made with the cyclotron."

AN APPARATUS FOR COUNTING COSMIC RAYS

A DEVICE enabling the fastest and most accurate counts ever made of cosmic rays and other particle radiation has been developed in the laboratories of physics at Harvard

University by Dr. E. C. Stevenson, instructor of physics, and Dr. Ivan A. Getting, junior fellow.

With the new instrument, technically known as a scaling circuit, random electrical impulses coming only a fifty thousandth of a second apart can be distinguished and counted. The circuit is so stable counts can be made at these speeds for months on end without any effective changes in the equipment.

The device was designed to fill the need for such an instrument in a long-range program of counting millions of cosmic rays daily recently undertaken at Harvard. No mechanical counter is fast enough and previous electrical circuits were either too slow or too unstable. The device is also expected to be of considerable value in counting the emanations from artificially radioactive substances built up in the new cyclotron. Many of these substances shoot out tremendous numbers of particles.

The new scaling circuit does not receive cosmic rays or other particle radiations directly, but rather the electrical discharges produced by these particles in a standard Geiger counter. This is a long glass tube filled with gas at a critical electric equilibrium. A particle passing through the tube upsets this equilibrium to produce an electric discharge. These impulses are fed into one end of the scaling circuit, where their number is divided by two, four, eight, sixteen or thirty-two, depending on how the apparatus is adjusted. Thus the impulses are scaled down sufficiently to permit their being counted by a plain mechanical counter attached to the circuit outlet.

A NEW SYSTEM OF TELECOMMUNICATION

A NEW system of telecommunication that uses the tone generator from the Hammond electric organ as an integral part of the wire circuit and makes possible simultaneous transmission of ninety-six messages over existing telegraph facilities has been installed on Western Union lines between New York and in a number of key cities.

Intended for eventual extension throughout the country, the new system uses the electric organ tone generator to generate a number of electric currents, each of a different frequency, which can carry messages at the same time over the same wire without interfering with each other. The system has already been applied to the circuits linking New York and Chicago, New York and Washington, New York and Atlanta and New York and Buffalo.

It makes use of the "carrier current" principle, the most important general development in the field of telegraph and telephone communication in the last three decades. A number of alternating currents, which can be sent over the same wire without interfering with each other if they are sufficiently widely spaced, carry the message, which can either be a voice message as in telephony, or the telegraph message. The latter is transmitted by interrupting the carrier current in accordance with a code.

The tone generator from the Hammond organ, which replaces bulky pipes and reeds with compact electrical

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apparatus, is used to produce the different low-frequency carrier currents used in the Western Union system. The electric organ uses a current of a given frequency to generate a musical note whose pitch or frequency is the same. The frequencies are spaced 300 cycles per second apart, making possible 22 simultaneous currents on a single circuit. As a result of methods previously in use, each frequency can be made to carry a number of messages, making possible the total number of ninety-six.

THE CHIEF CAUSES OF ACCIDENTS

THE seven chief causes of automobile accidents in the United States were listed by Sidney J. Williams, public safety director of the National Safety Council, who made a report for the American delegation to the International Road Congress at a meeting held recently at The Hague, the Netherlands. They are:

1. Exceeding the speed limit or driving too fast for road, visibility and other conditions.
2. Driving on the wrong side of the road.
3. Disregard of stop signs and signals.
4. Improperly failing to yield the right of way at intersections.
5. Attempting to force entrance between moving vehicles to avoid collision with an on-coming vehicle.
6. Attempting to pass on a curve or hill a vehicle moving in the same direction.
7. Failing to indicate intention of stopping or turning.

Systematic research by a large number of individuals and organizations over a period of years has brought out these and other facts. Describing safety work in the United States, Mr. Williams cited figures showing that systematic safety drives in a number of cities have succeeded in materially reducing the high accident rate.

More detailed and more uniform accident reports are still needed in the United States, however, in order to provide a basis for sound highway engineering, a field in which vast sums of public money are being spent. Quoting from a report submitted by A. A. Anderson, of the Portland Cement Association, Mr. Williams said: "It is essential that such information include data which will permit listing accidents on a vehicle mile basis for specific highways, day or night; and a rating to be made of the physical safety of each highway in relation to conditions causing accidents. This will mean mandatory provisions by the state or local government for reporting all details incident to highway accidents. When all contributing factors are obtained, it will be possible to develop an accident expectancy formula." This would enable accident frequency prediction and determination of how much rebuilding of a given highway would reduce accidents. This would provide a basis for judging on a dollars-and-cents basis whether a given road expenditure is justified.

MOUNTAIN BUILDING

WILL the next era of mountain building see the raising of peaks from the swamps and bayous of Louisiana, the muddy farmlands of the lower Nile and the lower reaches of the Ganges?

Geologists, studying the rocks of the great mountain

ranges, find that they once were sediments, like those now being deposited on the deltas of our great rivers. Once the mountains were shallow seas, the dumping grounds of great rivers that tore away fragments of rock from other highlands, carried them to the sea, and then dropped them as the fresh waters of the rivers mixed with the still salty ocean waters and came to rest.

Dr. Andrew C. Lawson, the California geologist, who has determined much of the past history of many mountain ranges, predicts that the great deltas of to-day's rivers will be the mountain ranges of the geological tomorrow—millions of years in the future.

Long ago, geologists found that deltas sank as more material was piled upon them by the rivers. Dredgings uncovered modern stumps some hundreds of feet below the surface of the Mississippi delta. Theories were evolved to account for this sinking, and out of these studies has come Dr. Lawson's concept of mountain building.

When a great delta is "loaded" with muds and sands and silts, it tends to sink, just as the swampy ground does when heavy structures are built on it. Far below the surface, plastic rocks are forced away from the compressed delta area, forming highlands around the delta.

Eventually, with this loading and sinking, a geosyncline, or great trough, may be produced. The exact time is hard to predict, for the sinking may not go on as fast as the loading.

Later, perhaps millions of years later, when the geosyncline is filled with sediments, internal earth forces uplift it into a mountain range, which then goes through the whole cycle again.

An ideal delta, according to Dr. Lawson, is about 32 miles long, and reaches out into water $2\frac{1}{2}$ miles deep. Sediments are piled on to the delta until they are about 40,000 feet thick, which seems to be the limit for sedimentary deposits. The time necessary for this growth, Dr. Lawson calculates from studies of the Mississippi delta, is about 55,000,000 years, or roughly from the time of building of the Rocky Mountains until to-day.

In North America, the building of great deltas is going on at the mouths of the Mississippi and Colorado Rivers. As the Mississippi delta is the largest and fastest-growing, we can expect the mountains-from-deltas cycle to progress more rapidly there than at the mouth of the Colorado.

As the Appalachian and Rocky Mountains wear away, their "tailings" start the building of new ranges, which in turn will wear away, continuing the ceaseless change through time that characterizes geologic history.

FLOODS IN THE YELLOW AND YANGTZE RIVERS

WITH the warning trickles already the cause of not inconsiderable damage, serious floods in Kiangsu province, the heavily populated district around Shanghai, are anticipated within the next two weeks.

In that time the crest of the spring flood from the mountains of Tibet and western China regions, thousands of miles away where the Yellow and Yangtze Rivers rise, is expected to reach the eastern part of the country, the battlefield in the Sino-Japanese conflict.

Should the flood come to Kiangsu province in as widespread a form as it has already come to the region around the Lunghai railroad, it will be a severe blow to East Asia generally and to the luckless Chinese behind the Japanese lines particularly. For Kiangsu province, in the hands of the Japanese since the earliest days of the attack on Shanghai, is one of China's bread baskets.

With territory already flooded by the Yellow River included prominently in the list of China's food-growing districts, the starvation problem already faced by millions of Chinese will become more acute almost than it has ever been in the history of Central China. The problem will, of course, become most pressing a few months from now, for there will be no replacement for food reserves exhausted during the summer while the crops were supposed to be growing.

Flooding of Kiangsu province is apparently due to a combination of high water on the Yangtze and on the Yellow River, some of whose water appears to be flowing into China's mightiest stream by way of the Hwei River and Grand Canal. Were floods near the delta occurring, flooding further up the Yangtze River would be taking place. This latter may still occur, but would in most cases be due to damage to the dykes either as a by-product of the fighting or as a deliberate stroke of military strategy.

The flood of Kiangsu province may likewise render even more tenuous the Japanese grip on that territory. Japanese, a number of surveys have shown, actually control, in much of the country they have nominally occupied, only the cities and the railroad rights-of-way. Flooded countryside is an additional obstacle to their mechanized forces. However, it does not represent nearly so severe a handicap to the partisan bands of guerilla fighters who have scored heavily for the Chinese.

LEONARD H. ENGEL

ITEMS

USING "tagged" atoms, investigators in Copenhagen are learning how muscles, broken down during exercise, are rejuvenated during rest. Professor G. Hevesy, of the Institute of Theoretical Physics, and Professor O. Rebbe, of the Zoophysiological Laboratory, have studied how the muscle substance, known as creatine phosphoric acid, breaks down during muscular exercise and how it is rebuilt or "rejuvenated" in the resting muscles. Atoms of sodium phosphate were labeled by making them artificially radioactive, so that no matter where they might be their presence would be detected by the radiations they produce. Some of this labeled sodium phosphate was injected in frogs and then, at various time intervals, creatine phosphoric acid was extracted from the muscle. The replacement of the phosphorus atoms could thus be traced.

SUPERSONIC WAVES—sounds too shrill in pitch to be heard by the human ear—will soon be used to break up solid particles into new degrees of fineness. Sound's new use has been developed from research of Dr. Karl Söllner, of the department of agronomy at Cornell University. Dr. Söllner found that high-frequency sound waves not only make sediments, gels and precipitates disperse—as previously had been known—but also that certain solids

having a laminated structure could be broken into fine bits by the intense vibrations created. Dr. Söllner has filed a patent application on his process which has been assigned to the Acheson Colloids Corporation. Materials on which the supersonic waves work well include graphite, mica and steatite. As soon as production changes are completed, colloidal graphite will be made of much finer particle size and longer suspension than has heretofore been available to industry.

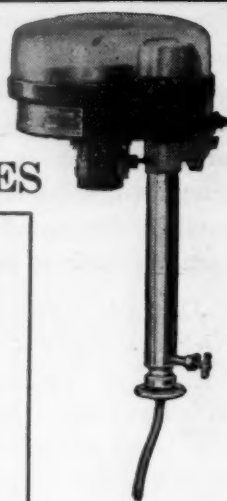
JAMES S. VANICK and J. T. Eash, of the International Nickel Company, reported recently to the American Society of Testing Materials that steels of hardness so great that they approach that of the diamond are now being produced. The standard methods of measuring hardness are no longer sufficiently exact for modern industry they added. For special chromium-nickel alloy cast irons some 16 tests of hardness, where a diamond point is pressed into the metal, are now required to get enough data to arrive at a suitable determination. Tests using a tungsten carbide ball pressed against the metal can give closely uniform values with only two or three determinations.

A LABORATORY instrument has been taught to do card tricks by Professor Christian A. Ruckmick, of the University of Iowa, whose "emotion meter" was originally constructed as a research tool and later was used as a "lie-detector." The victim is shown a full pack of cards, and told to select one mentally. As Professor Ruckmick runs through the pack, asking if each is the chosen card, the subject follows instructions by saying "No." When a band of light on a ruled scale at the front of the foot-square box, which is the emotion meter, fluctuates, the scientist knows the chosen card has been reached. The excitement of telling even so small a lie is enough to change the electrical resistance of the skin cells and deflect the indicator.

PÈRE ARTHÈME DUTILLY, Canadian missionary-botanist who has been conducting research at the Catholic University of America, has sailed from Montreal, to skirt the coast of Labrador into Hudson Bay and land at the remote trading town of Fort Churchill. There he will meet an American botanist, Father Maximilian Dumann, of St. Vincent's Archabbey, Latrobe, Pa., who has been botanizing in Saskatchewan Province since the end of June, and who will proceed to Fort Churchill by the far northern railway. From their remote rendezvous they will proceed northward and westward into lands even more remote, studying the vegetation of the tundras of the Canadian Arctic and collecting specimens to bring back when the first snows drive them out in early autumn.

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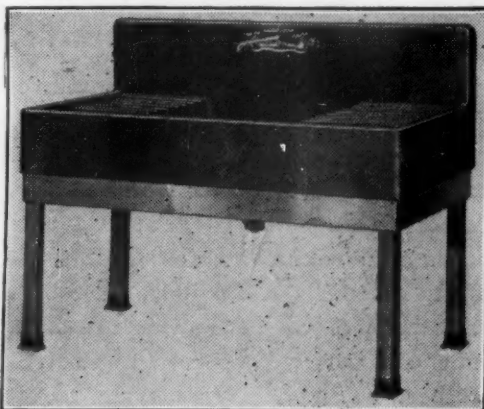
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SCIENCE NEWS

Science Service, Washington, D. C.

REPORT OF THE TECHNICAL COMMITTEE
ON MEDICAL CARE

A LIFE-SAVING plan was presented to the National Health Conference at its meeting at Washington, D. C. This plan is the program for providing adequate medical and health care to the entire population drawn up by the Technical Committee on Medical Care of the Interdepartmental Committee to Coordinate Health and Welfare Activities. Members of the Technical Committee are: chairman, Miss Martha M. Eliot, of the U. S. Children's Bureau; Dr. I. S. Falk, of the Social Security Board; Dr. Joseph W. Mountin, George St. J. Perrott and Dr. Clifford E. Waller, of the U. S. Public Health Service.

The Technical Committee states that "A major reduction in needless loss of life and suffering, an increasing prospect for longer years of productive, self-supporting life in our population will be achieved by this plan within a decade." The maximum cost to federal, state and local governments of the first three features of a five-point plan is estimated at \$850,000,000 every year for ten years. The committee believes it will take ten years of gradual expansion of medical and health services for it to become fully effective.

The first recommendation of the Technical Committee is to expand general public health services with the hope of eradicating tuberculosis, venereal diseases and malaria, controlling deaths from pneumonia and cancer, and fighting mental diseases and industrial diseases more effectively. This part of the program is expected to cost \$200,000,000 annually, half of this sum to be borne by the Federal Government. In addition, the committee recommends expanding material and child health services, with the object of making "available to all mothers and children of all income groups and in all parts of the United States minimum medical services essential for the reduction of our needlessly high maternal mortality rates and death rates among newborn infants, and for the prevention in childhood of diseases and conditions leading to serious disabilities in later years." Annual cost: \$165,000,000.

The second point in the committee's plan provides for 360,000 hospital beds, in addition to those already in existence, in general, tuberculosis and mental hospitals and in rural and urban areas, and for the construction of 500 health and diagnostic centers in areas inaccessible to hospitals. These new hospitals and clinics would require financial assistance for the first three years of operation. Averaged over a ten-year period, the total annual cost is estimated at \$146,050,000, half of this to come from federal funds.

The third point in the plan is for providing medical care to the medically needy. Starting with \$50,000,000 the first year, this part of the program, it is suggested, should be gradually expanded till it reaches the estimated level of \$400,000,000 which would be needed to provide minimum care to the medically needy groups. The Federal Government to meet one half the annual costs.

The fourth point in the plan is for reducing the burdens

of sickness among self-supporting persons. It is suggested that this can be done "without great increase in total national expenditures" by devices for distributing these costs among groups of people over periods of time. Suggested methods of financing would be either by general taxation or special tax assessments, or specific insurance contributions from potential beneficiaries, or both. The rôle of the Federal Government, the committee states, "should be principally that of giving financial and technical aid to the States" for development of sound programs of their own choice.

The fifth and final point recommends providing insurance against the loss of wages during sickness.—JANE STAFFORD.

THE GEOGRAPHIC DISTRIBUTION OF
HOSPITAL SERVICE

(Copyright, 1938, by Science Service)

In the United States 98.5 per cent. of the people live within thirty miles of a hospital. A map showing the geographic distribution of hospital service is published in the *Journal of the American Medical Association*. Statistically there are 9.3 hospital beds for each thousand of population, but since many of these beds are for patients with mental disease, the ratio is cut to 4.6. Such ratios, the medical journal states in an editorial, do not suffice to answer the question as to adequacy of hospital service.

Much depends, an editorial states, on whether the population is rural or urban, on the type of housing which prevails, on the availability of servants, on the habits of the people and the degree to which they have become accustomed to the idea of hospitalization for minor illness. In 1937 those states which had the highest occupancy of hospital beds were the states that had the highest bed ratio, while the states that had the smallest number of hospital beds had the largest percentage of unoccupied beds. This is interpreted as an indication that hospitals have been built where they were needed and have not been built where they are not needed.

In commenting on the study, Alden B. Mills, Chicago, managing editor of *The Modern Hospital* and author of a recent study on "The Need for More Hospitals in Rural Areas," pointed out that there is an important distinction between the true need of any given population for hospital care and the amount of care that they may be able to buy under present conditions. Many of the registered hospitals in the areas of greatest need are small proprietary institutions that can not afford to do any charitable work since they must pay their bills entirely out of their earnings. "Obviously this is quite a different situation from that found in large cities where there are large city or county hospitals as well as voluntary institutions for the care of those who can not pay."

TRAVELING CLINICS FOR AUTOMOBILE
DRIVERS

MOUNTED in a delivery truck, a clinic for "unhealthy" automobile drivers has been visiting some sixteen states

under the auspices of the Harvard Bureau of Street Traffic Research in the interests of safer driving. Accident repeaters and traffic law violators are surprised to receive an invitation from police officers to appear voluntarily for tests and personal advice. Newspaper publicity leads many others to the clinic for testing.

The tests showed that eight out of ten drivers are prudent, conscientious and proficient and are proud of their driving. Accidents are caused by a small group, less than five per cent., who can pile up an amazing record of trouble over a period of years. The safest age for drivers is in the 40's and 50's. Individual defects account for some accidents, and some of these can be remedied once the driver is aware of them.

Dr. Harry R. DeSilva and Ralph Channell reported to the *Journal of Applied Psychology*, in describing these traveling clinics, that in the California clinic it was found that fully a fifth of all drivers in fatal accidents had poor vision in one eye. "The seriousness of this condition was accentuated when it was found that in every case the accident occurred on the side of the weak eye."

Amusement is sometimes provided by the tests. "In Vermont a patrolman brought in an intoxicated driver he had picked up a few blocks from the clinic. The inebriated driver welcomed the opportunity to prove that he was in perfect fettle. To his discomfiture he found himself utterly unable to carry out simultaneously the several activities demanded by our vigilance test. After watching a normal person make a good score on the test he confessed his amazement at the demonstrated deterioration of driving ability from alcohol and vouchsafed that he would never again drive after drinking."

Occasionally superior ability may get a driver into trouble. "A salesman came in bragging of his fast reaction time and efficient booster brakes. His score on the braking reaction test confirmed his statement. A study of the motor vehicle department records indicated, however, that he had been the victim of seven rear end collisions. After the supervisor pointed out the disadvantage, in his case, of a faster than normal reaction time and super brakes, he went away vowing never again to brag about or get into trouble as a result of his super-normal ability to stop quickly."

GOLD IN NEVADA

DISCOVERY of high-grade ore running up to \$2,000 a ton in value on new claims has precipitated a gold rush to Cimarron District, 29 miles north of Tonopah, Nev., opening up a new field destined, perhaps, to create a boom camp equal to the old days. Since E. M. Booth made the rich strike last month between 500 and 600 claims have been staked out over a mineral range four miles long.

The range is part of the geological upheaval which made Tonopah and Goldfield such fantastically rich gold camps. Surface showings of the new strike are so phenomenal that ore with values up to \$2,000 a ton is being encountered 20 feet below the surface of a 7,500-foot peak. Shrewd and conservative mining men predict that the strike could easily surpass Goldfield and Tonopah, both teeming mining camps in their heyday, producing some \$500,000,000 in gold together.

Nevada has not had a strike in more than a decade that has created so much excitement as have values uncovered in the Cimarron District. Less than a month ago 12 of the 16 claims staked out by prospector Booth and his wife were purchased by Pacific Butte Mines Company for \$185,000, in addition to other considerations.

The company, headed by Fred Vollmar, veteran Silver Peak mine operator, now is driving a 500-foot cross-cut tunnel through the center of the rich claims which cover an area of approximately one mile square. This tunnel is now over 75 feet long. Booth panned a wide section of the mineral range and believed that he staked the heart of the district which he named Cimarron. The cross-cut is being driven into the mountain 200 feet below the high-grade strike, much of which is free gold, and within a few feet of where Mrs. Booth struck a vein that assayed \$168 a ton. From surface showings, Booth has concluded that the cross-cut will tap five veins, and possibly two more that he suspects exist.

The purpose of this tunnel is to determine the width and depth to which the veins go into the earth. Should the cross-cut verify surface showings officials plan immediate construction of a mill capable of handling 2,000 tons of ore daily, making it the largest gold operation in the state.

Twisting roads to the diggings are now being scraped and graded so that mining equipment may be brought in. A tri-weekly air service is being started between Los Angeles and Tonopah to carry interested mining operators. Five tons of mine rails, large air pipe, ties and lumber have already been carried into the region from Tonopah, indicating that extensive work is under way.

THE CONTROL OF GRASSHOPPERS

POISONED bait—180,000 tons of it—is joining with the long wet spell of the early spring and summer to keep grasshopper-fighters abreast of these costly insect pests so far this season, according to a statement made by officials of the U. S. Department of Agriculture.

Through the great central area of the Middle West, Iowa, Wyoming, Nebraska, Illinois and South Dakota, hatching of grasshoppers has been greatly delayed by the weather. Danger points are in North Dakota, New Mexico, Texas and Oklahoma. The grasshopper picture is changing rapidly, however, and spots which now seem to be under reasonable control may, very shortly, become a battlefield between deadly bait and 'hoppers.

In all it is estimated that there are 15 different kinds of grasshoppers. Each variety has slightly different habits and its own method of control. The cool, wet weather of early spring and summer, for example, has helped the farmer in the case of those grasshoppers which lay their eggs along roadsides. The wet weather has made the grass grow well in these breeding spots. The grasshoppers are thus eating this near-by food before venturing, later, into the neighboring fields. Other grasshopper varieties which lay their eggs in the fields are, in contrast, essentially unaffected by growing grass on roadsides, for their nearest food is the field crop itself.

While cool, wet weather delays hatching and stays, for a time, the danger period for grasshoppers' greatest damage, this delayed hatching taxes the piles of poison

bait. Where hatching comes along quickly and with most of the 'hoppers coming out all at once a single application of bait to the fields may suffice. In delayed hatching the grasshopper colony grows gradually and several doses of the poison are needed for control. The bait consists of a mixture of bran, arsenic and either sawdust or cotton seed hulls.

METHODS OF FLOOD CONTROL

Luther M. Winsor, engineer of the U. S. Department of servation differs markedly from the problems of the East, according to a report to the American Society of Civil Engineers meeting in Salt Lake City.

Luther M. Winsor, engineer of the U. S. Department of Agriculture, Salt Lake City, pointed out that the popular solution of the flood problem in the East is to undertake extensive plantings on the watersheds of streams and thus ease the flow during flood periods. This "upstream engineering" as it is called, with its motto "Stop the Raindrop Where it Falls," is good practice in the humid East with its plentiful rainfall, but it is not good practice in the arid West where water is precious. Water is so scarce in some parts of the West that it would be poor judgment to keep it up on the mountain tops growing trees and vegetation, while the farmers in the valleys are crying for water.

Mr. Winsor pointed out that there can be no blanket rules about flood control, soil erosion and water conservation. Each section of the nation has its own special problems. In the West soil erosion from the rocky, mountainous peaks is sometimes useful for it brings down into the arable valleys soil that is needed. The Bureau of Agricultural Engineering has developed a system of controlling floods in the West and making torrential streams drop their deposits of silt where they will do the most good. The carrying power of a stream varies with the sixth power of its velocity. It can be shown that if a stream can be slowed to half its velocity it will deposit 63/64ths of its load of mud and debris.

As used in many parts of the West, flood control allows the torrential creeks and tiny rivers to flow unchecked down into the valleys and to flatter places where a low barrier wall is set up around an area in which the debris load of the stream is to be deposited. As the stream widens out at this point its velocity decreases and the debris fills in the area. Such structures can be built for only 60 per cent. of the cost needed each year for cleaning gravel and boulders from lateral irrigation canals.

ITEMS

It is reported in the *Journal* of the Optical Society of America by Dr. E. O. Hulburt, of the U. S. Naval Research Laboratory of Washington, D. C., that by using the fleeting rays of the setting sun investigators have measured the temperature high in the stratosphere, far beyond the reach of any possible balloon ascensions. The temperature from 8 to 35 miles above the surface of the earth comes out to be -50 to -80 degrees Fahrenheit. The measurement of the brightness of the light in the zenith sky an hour after sunset and an hour before sunrise made the findings possible.

SENDING instruments eighteen miles up into the stratosphere, scientists of the California Institute of Technology, headed by Dr. Victor Neher, have just begun the newest study of cosmic rays direction and intensity at Oklahoma City, Okla. Strings of small hydrogen-filled balloons bore aloft the delicate apparatus which will automatically register cosmic ray intensity. The equipment rises until one or two of the small balloons burst and then the rest bring it slowly and safely to the ground, to be returned by farmers for a small reward. Tiny ping-pong balls play an important rôle in the equipment being used to reflect light into a small camera which takes robot pictures of the instrument readings while the flight is in progress.

MARY GOVER, associate statistician of the U. S. Public Health Service, points out in *Public Health Reports*, issued by the service, that during a heat wave a four-fold increase in the death rate over the expected death rate may occur, although not all the excess deaths are due to sunstroke or heat prostration. The heat may be certified as responsible for about a quarter of the excess deaths, as in Kansas during July of 1934, but during a heat wave there are also more than the expected number of deaths from heart diseases, cerebral hemorrhage, kidney disease and pneumonia. It was found that if two heat waves strike a community during one summer, there will not be nearly so many excess deaths during the second one. This may be partly due to the fact that most of the deaths among persons with chronic disease of heart and circulation were hastened during the first hot spell. It may also be due to acclimatization. Sharp increases in mortality related to heat waves occur most frequently in July and in states of Ohio, Indiana, Illinois, Missouri, Iowa and Nebraska. North Atlantic cities are also frequently affected. Least affected are the Pacific Coast and the far South. Miss Gover attributes the few excess deaths in the South to acclimatization. A number of consecutive days of extreme heat have more effect on the death rate than variable temperatures.

A LARGE amount of the hundreds of millions of dollars that annually are spent for federal construction projects is wasted because the United States lacks adequate maps, said Dr. William Bowie, formerly chief of the Division of Geodesy of the U. S. Coast and Geodetic Survey, before meetings in Salt Lake City of the American Society of Civil Engineers. For only a fraction of the cost of the government's projects the whole area west of the Mississippi River could be accurately mapped in five years. Eleven million dollars would be the cost of this job. While the sum seems large it would be returned, many times over, by the prevention of wasteful methods, due to poor maps. While 48 per cent. of the nation is topographically mapped, only about 15 per cent. is adequately mapped. Most of the present maps are too old or on too small a scale to be useful in construction projects. Dr. Bowie said: "Vast amounts of money are spent annually on the public works and yet they are carried on in most instances without a knowledge of the physical facts of the earth's surface, that can be shown on a modern topographic map. The waste involved is enormous and it is inexcusable."

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SPECTROSCOPE AND STANDARD MEDICAL TESTS

For the first time in the history of medicine, standards depending on analysis with the spectroscope, the most powerful research tool of science, have been accepted for a medicinal product by the American Medical Association.

This was reported to the session of the Massachusetts Institute of Technology Spectroscopy Conference by Dr. Henry R. Kreider, of the chemical laboratory of the American Medical Association, who related the spectroscopic requirements which riboflavin, or vitamin B₂, must meet to gain approval of the council on pharmacy and chemistry of the association.

Heretofore, the standards for medicinal products have been determined largely by chemical and physical methods, but the spectroscope provides an "excellent means of standardization" and it will probably find wider and wider use with passing time. Dr. Kreider stressed the ability of the powerful eye of the spectroscope to detect extremely small but nevertheless therapeutically significant amounts of metals in medicinal compounds, whether they are present as impurities or as physiologically active ingredients. In one case he described, a salve claimed to contain mercury in organic combination baffled all attempts to detect the mercury chemically, but the spectroscope quickly revealed its presence, although in an amount much smaller than that claimed.

The spectroscope has also been very useful to the laboratory in examining physical therapy equipment such as therapeutic lamps and ultra-violet ray lights, for it enables precise investigations of their emissions and easy comparison with standards. Still another example of solving puzzling problems accurately, quickly and cheaply is the use of the spectroscope in testing portions of a patient's skin for metals. In this case a small piece of tissue is removed and examined under the spectroscope.

O. Ivan Lee and Thomas A. Wright, both of Lucius Pitkin, Inc., reported a comprehensive attempt to correlate the 2,700-odd recognized minerals into an organized table which would enable the most precise and careful analysis. The result is a simple but extensive chart of minerals, designed for daily use by the spectroscopist and mineralogist, a distinct contribution to the art of determinative mineralogy. It is the first set of tables of this nature since 1925.

SPECTROSCOPIC DETERMINATION OF THE NATURE OF VITAMIN B₁

A SIGNIFICANT chapter in the history of science was related when Dr. A. E. Ruehle, of the Bell Telephone Laboratories, a member of the group whose research paved the way, in 1936, for the laboratory manufacture of vitamin B₁, the anti-neuritic vitamin, told the story of the research before the Spectroscopy Conference. His story was also a chapter in the many which could be written concerning the contributions to scientific progress of the spectroscope.

Dr. Ruehle was a member of the group working under Dr. R. R. Williams who applied the spectroscope to learn the manner in which the atoms of the vitamin are hitched together and thus provide the clue most badly needed for duplicating it in the laboratory.

Ultra-violet absorption spectra were particularly well fitted for this work, Dr. Ruehle pointed out, for not only does the delicate technique yield precise analyses, but it has the added advantage of requiring only minute amounts of the substance under investigation for these tests. This was a great advantage over other analytical methods with vitamin B₁ because only small amounts were available for study. In the research unusual and extensive use was made of absorption spectra in an effort to secure hints as to what products were formed in various chemical reactions with the vitamin, how the atoms in the vitamin molecule divided, and to confirm later chemical findings.

The vitamin molecule, it was found, can be chemically split into two parts and by comparing the spectra of one of these and its derivatives with those of corresponding derivatives of a chemical known as thiazole, strong evidence was obtained that there was a so-called thiazole ring in the vitamin. This finding, incidentally, was later confirmed by the chemical synthesis of this part of the vitamin and was given by Dr. Ruehle as the first evidence of a thiazole derivative in nature.

Similarly the other portion of the vitamin molecule was shown by absorption spectra to contain a pyrimidine ring, and it was indicated that at a certain place on the ring an amino group was substituted for another group. Use of absorption spectra also gave the investigators the first evidence of the manner in which these two rings were linked together in the vitamin molecule.

From this information Dr. Williams and his associates were able to establish absolute chemical proof of the manner in which all the atoms comprising the complex vitamin molecule are hitched to each other and furnished chemists with the stepping stone to artificial manufacture of the vitamin a short time later.

THE SPECTROSCOPE AND CELL RESPIRATION

Dr. T. R. HOGNESS, of the University of Chicago, speaking at the Spectroscopy Conference, stated that an understanding of the problem of cancer may well lie in a better understanding of how the cells of the body breathe, for the abnormal cell growth which characterizes cancer is linked with abnormal respiration.

Reporting spectroscopic studies that he has made of respiratory enzymes, Dr. Hogness emphasized the fundamental relationship between respiration and growth, adding the prediction that the keen eye of the spectroscope "will play a large rôle in our final understanding of cancer." Earlier in his paper Dr. Hogness had explained how this "master key of science" had enabled marked advances in man's understanding of the rôle of

the complex respiratory enzymes in bodily processes. With older methods of attacking this important problem only the total effect of all cellular processes could be studied, but the spectroscope has permitted the isolation and investigation of each individual step. The fundamental problem of cell growth will not be understood until the respiratory process of cells is known and that depends on knowing how enzymes function in the utilization of food and oxygen.

Dr. Hogness is studying the chemical reactions whereby sugar gives up hydrogen, which combines with the body's oxygen to form water. Water and carbon dioxide are the two waste products in this system, one of the simpler transitions of the many involved in life. The first three steps are known; how the hydrogen goes from sugar to an enzyme, to another enzyme and then to cytochrome-C, another enzyme. Dr. Hogness has studied the properties of this last substance in his quest for the next one, a major missing link in the chain. Indications are that it is a very heavy protein.

THE CHEMICAL CONSTITUENTS OF PLANTS

A FIVE-YEAR exploratory program designed to discover the effects of nitrogen, phosphorus and other elements on the growth and chemical composition of various forage plants was described to the conference by Dr. B. C. Brunstetter, of the U. S. Bureau of Plant Industry.

Eighteen different kinds of grasses and legumes were grown in Maryland for the investigation, including types of plants most common in pastures in the north humid part of the country. These were fed various fertilizers and then spectrographically examined to determine their content of such important mineral substances as magnesium, manganese, aluminum, copper, iron, potassium and calcium.

Principally the study furnished important background material on the mineral content of plants grown in Maryland soil and under that region's climatic conditions. Dr. Brunstetter emphasized that any interpretation or application of the findings must await similar analyses on similar plants but under different environmental conditions. Only such comparisons, he said, can hope to lead to the discovery of laws governing the absorption of phosphorus, nitrogen and potassium by forage plants. Dr. Brunstetter suggested that additional similar studies would probably bring to light cases where the soil is deficient in one or more of the elements essential to plants.

Dr. Brunstetter also pointed out that those elements essential to plants are also usually essential to animal life. Thus while milk is an excellent source of minerals for man, the amount of these minerals contained in the milk is largely dependent on the amount found in the forage grasses eaten by cows. This in turn depends on the amount in the soil in which the grasses are grown.

Assisting Dr. Brunstetter in the research were Dr. A. T. Myers, Dr. H. L. Wilkins and Dr. M. A. Hein, all of the Bureau of Plant Industry.

THE NATIONAL HEALTH CONFERENCE

The great problem of medical care for all has been projected by the three-day National Health Conference

at Washington, D. C., into a major position among the issues before the nation.

When political parties and candidates begin to build their platforms, hardly any who hope for success will dare to leave out a plank for some sort of program for health protection and medical care. The voice of labor, agriculture and other consuming groups will be raised too insistently not to be heard and heeded.

Some phases of the \$850,000,000 per year health program outlined by the government experts will undoubtedly come before the next Congress, and some provisions may rush to enactment with unanimous approval just as anti-cancer funds were voted by the last Congress.

Medical insurance, modeled along the lines of job insurance under social security is now emerging as a matter discussed by the people as well as by the experts. In some American form, a new kind of compulsory, government administered "life" insurance for the living, paying the medical bills when the great disaster of illness comes, seems almost sure to become a part of our social order. How soon, is a question. Three years? Five years? A decade?

The prevailing feeling among physicians, as crystallized by leaders of the American Medical Association, is opposed to any change in the usual system of individual engagement of doctors on a fee basis. "State medicine" is anathema to most of them, although a leaven of growing hundreds, the informal Committee of Physicians, favors and is expected to endorse formally the general health plan of the conference. Many physicians will join these liberals when they realize that it is the duty of the medical profession to respond to this national cry for the doctor, just as the family practitioner traditionally arises in the middle of the night to bring a new baby into the world.

Organized medicine at the conference just closed undoubtedly had impressed upon it the extraordinary fact that there is more demand for their commodity of disease prevention and treatment than they can supply. They were told that hundreds of practicing physicians are partially unemployed—with office hours too often leisure hours—while ill millions go untreated. It is a gigantic problem of distribution.

The public is calling for the doctor and trying to work out the best way to pay him. This is an old personal problem that is becoming a national issue. It is one that every one will hear more about in the months to come.—WATSON DAVIS.

TRANSATLANTIC SURVEY FLIGHTS

WITH the open season for transatlantic ocean hops already launched by the Hughes flight, Douglas (Where am I?) Corrigan and now the Mayo composite *Mercury* seaplane of England, the plans for further airline survey flights across the North Atlantic are without American participation this summer.

If America seems backward in this respect it only needs to be recalled that Pan-American Airways is about three years ahead of the field and its survey work is complete. So far as American participation in transatlantic aviation, it could be started immediately. As of July 1, Pan-American Airways had fourteen complete

"ocean crews" available. Each one of these crews consists of a flight captain, pilot officers, flight engineers, navigators and radio officers who all have had at least 100,000 miles of transoceanic transport behind them. While American pilots and American planes are thus waiting, here is the program of foreign nations which will permit them to catch up in their survey flights.

England has three projects under way. The first—the flight of the seaplane *Mercury* after a launching from the giant flying boat *Maia*—is already completed. More flights with this same novel equipment will be made. In addition England plans to use the *Albatross*, a four-engined wood and plastic composition land plane designed especially for transoceanic service. And finally the flying boat *Cabot*, an enlarged version of the Empire seaplanes used last summer, will make test flights. The *Albatross* is due to take off early in September and the *Cabot* later in that month.

Germany, for the third year, will make flights (14 round trips in all) during the summer by way of Lisbon and the Azores. The *Nordmeer*, *Nordwind* and *Nordstern* will be launched by catapult from mother ships stationed at the Azores and at Port Washington, L. I., the seaplane terminal in America.

France, most backward so far in pushing its transatlantic service, plans at least six oceanic flights during the summer. One of the first flights will be that of the giant *Lt. de Vaisseau Paris*, 40-ton flying boat, with six engines, which has previously visited the United States by way of the South Atlantic and South America. The French route has not yet been decided, but the *S.S. Carimare* has been stationed in mid-Atlantic, for some months, to obtain the best weather data for transoceanic hops.

While Pan-American Airways is waiting for this foreign effort its "super-clippers" are under construction and the first—capable of carrying 72 passengers and powered by 6,000 horsepower—is now undergoing engineering tests at the Boeing factory in Seattle, Wash. This first seaplane will be ready for transatlantic service early in the fall and is believed to be an advance, of some several years, over anything which foreign nations have to offer for transoceanic commercial transport by air.

ITEMS

THE 317,000-pound horseshoe-shaped bearing for the 200-inch Mt. Palomar telescope has just been ground and polished until its surface is true to within five one-thousandths of an inch. Nearly as perfect as mechanical science can make it, the bearings soon will leave on the long water passage which will take it down the Ohio and Mississippi Rivers, across the Gulf of Mexico, through the Panama Canal and back up the Pacific to San Diego. From there it will be transported slowly up Mt. Palomar to the observatory of California Institute of Technology. Engineers at the Westinghouse Electric and Manufacturing Company were able to obtain the high accuracy of grinding surface only because they built a huge "sunbonnet" that shaded the bearing and reduced the swelling and shrinking of the enormous block of steel when the sun's rays shone on it, and then off again.

It was reported at the meetings in Salt Lake City of the American Society of Civil Engineers that a new giant steam turbine-electric locomotive, of a design different from any locomotive now in operation, will soon be placed in service on the Union Pacific Railroad. Charles P. Kahler, system electrical engineer of the Union Pacific, stated that the unit, creating at least 5,000 horsepower, will virtually be a steam generating electric plant on wheels. The locomotive, now under construction, will generate 45,000 pounds of steam an hour at a pressure of 1,500 pounds to the square inch. This high pressure steam will drive a main turbine spinning at 12,500 revolutions per minute. The turbine, in turn, will drive an electrical generator at 1,250 revolutions per minute. This electric power will drive the locomotive. The steam circulates through a closed circuit. After leaving the turbine it goes to an air-cooled condenser, is there turned back into water and sent back to the boiler.

OFFICIALS of the U. S. Bureau of Entomology are not particularly alarmed by the Japanese beetle situation which has the metropolitan New York area aroused. New York's problem, viewed on the broad-scale picture, represents the alarms which always occur in the outlying areas of infestation when the beetles' arrival is novel and the population is lacking in knowledge of control. As the presence of the beetles occurs year after year an area grows accustomed to them. Japanese beetle quarantine methods, now enforced, are keeping the insect pest under reasonable control since it was first discovered at Riverton, N. J., in 1916. In usual years twenty-five miles represents the maximum distance which an area of infestation will spread.

SMALLPOX virus particles, hitherto unseen even under highest microscopic magnifications, have been made visible by means of an improved electron microscope developed by Dr. Franz Krause, at Neubabelsberg, near Berlin. The particles, which are not "germs" in the ordinary sense, being very much smaller than bacteria, were rendered visible at a magnification of 2,000 diameters. The virus was mixed with diluted gelatin. A fine-meshed metal screen was dipped in this and the film allowed to dry on it. This was then examined through the electron microscope, working in high vacuum.

L. CARRINGTON GOODRICH, Columbia University associate professor of Chinese, reports to the *Geographical Review*, that the first appearance of syphilis in the Chinese Empire, now established as during the year 1505, immediately followed by the introduction of maize, both of American origin, gives the time when China first learned of America's existence. This disproves the 200-year-old belief that Mexico was discovered by a Chinese Buddhist monk in the fifth century, but does not mean, Mr. Goodrich says, that "during all this long period of time, roughly from the fourth century before Christ to the fifteenth century of our era, the Chinese knew nothing of the New World." The first Chinese map to record the Americas was published in 1584. It was prepared by the Jesuit missionary, Matteo Ricci.

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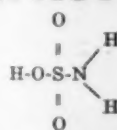
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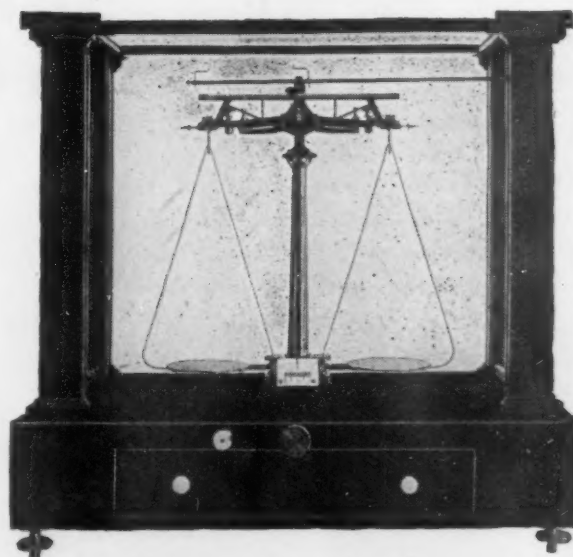
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THE STORAGE OF RADIUM

It is believed that a way may have been discovered to get around the awkward and hampering method of storing radium in solution. A new discovery, reported from Czechoslovakia, describes the use of silica gel as a dry "sponge" material in which radium can be stored for long periods without losing its effectiveness.

Most radium, it should be explained, is kept dissolved in the hospitals and other centers which may be fortunate enough to possess it. Elaborate pumps take off the gaseous disintegration product of this radium—the gas known as radon—which is sealed delicately into little metal containers called "seeds."

It has long been the hope that somewhere and somehow a dry material could be found which might serve as a more convenient storehouse for radium. A dry material could facilitate handling and shipment. Previously ferric hydroxide and comparable compounds of uranium and barium had been tried as a dry medium for storing radium. But, in all cases, the efficiency of the dry preparation was low, and it soon lost its emanating power.

L. A. Helwich, Czechoslovakian correspondent for *Industrial and Engineering Chemistry*, reports new work at the State Radiological Institute in Prague which shows silica gel overcomes past objections to a dry radium storing material. Tests show, he reports, that a dry compound of silica gel will keep 97 per cent. of its emanating power for years. Metals, such as magnesium, manganese, cobalt, aluminum and nickel—all in combination with iron—are used in the silica gel material to make the "sponge" for radium. Drs. P. Parchomenko and F. Behounek of the institute made the research investigation.

EFFECTS OF HEAVY WATER

DEATH or a faster life are the effects of drinking heavy water instead of ordinary water, depending upon amount of heavy water consumed. Dr. H. G. Barbour, of the Yale University School of Medicine, reported to the Ottawa meeting of the American Association for the Advancement of Science, experiments in which white mice die in about a week if all their ordinary drinking water is replaced by water whose hydrogen is the heavy or double-weight sort.

Ever since 1935 when the existence of heavy hydrogen was discovered, scientists have been wondering what would happen if a person drank heavy water instead of the ordinary natural kinds. When a European professor drank a small amount it made the headlines a few years ago. Until recently it was difficult to produce enough of the heavy water to use in large-scale experiments.

When animals like mice are kept only one fifth saturated with heavy water, they are not poisoned but their life processes are kept going at a faster rate, Dr. Barbour found. The heavy water stimulates the sympathetic nervous system, raising the hair of the animals as though they were frightened and producing pop-eyes. Dr. Barbour found that this effect is produced by heavy water protecting and preventing the decomposition of the epinephrine which is

poured into the body, usually disappearing too fast to sustain these effects.

The growth of cancer in mice is slowed when the fluids of their bodies contain a fifth heavy water, but unfortunately for any possible use of this effect the mice do not survive so long as ordinary mice with the same tumors. A condition of catalepsy was induced in rats, cats and a monkey by direct application of deuterium oxide to the outside of the brain. This impairment of physical and mental action is the first effect of heavy water to be observed on an animal closely related to man.

WATSON DAVIS

OZONE AND ULTRA-VIOLET LIGHT VARIATIONS

IN the weather reports of a few years hence there may be a line running something like this: "Ultra-violet radiation increasing due to less ozone in the upper atmosphere; sun-bathers should expose themselves with care."

Predictions and records of ozone promise to be important not only to bathers exposed to sunshine but to physicians who use sunlight as medicine, farmers whose crops are influenced by sun energy, weather experts who must make forecasts and others.

To the Ottawa meeting of the American association, Dr. Brian O'Brien, of the University of Rochester, announced a new instrument that measures and records the ozone in the upper atmosphere. It may soon be standard equipment in weather stations in various parts of the world.

Ozone is oxygen in very active form and a very little of it has vast influence on the quality of the solar radiation that gets to the earth's surface. If all of it were eliminated from the air, all of us on the earth would be killed in a short time, so powerful would be the ultra-violet radiation that would be allowed to come to earth.

Yet all the ozone in the earth's atmospheric blanket, situated mostly at an altitude of 25 miles, would be sufficient to make a layer only two millimeters thick, about the thickness of two ordinary pencil leads. The ozone absorbs part of the solar radiation, the invisible ultra-violet area of the spectrum that lies in the neighborhood of Angstrom units.

While it was assumed in early researches that the ozone was more or less constant in amount, new work indicates that it may vary from day to day and year to year. There may be clouds of ozone analogous to the clouds we see in the sky. These may affect weather, and knowledge of them may help the accuracy of weather predictions in the future.

The intensity of ultra-violet light is known to vary with the solar cycle, with more getting through to earth when sunspots are more numerous. Since we are now at about the peak of the sunspot cycle or a bit past it, bathers probably should expose themselves to the sun with greater care now than was necessary some years ago. Dr. O'Brien's ozone recorder measures the ultra-violet light, charts it upon motion picture film and allows a continuous record of the changes in the ozone layer in this way. Since it costs only

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about \$2,000 there is hope that these instruments can be scattered over the world at principal weather stations.

WATSON DAVIS

THE DANGER IN CANCER TREATMENT

THE patient is chiefly to blame in those cases of cancer in which treatment is started too late to effect a cure, it appears from a study reported by Drs. George T. Pack and James S. Gallo to the *American Journal of Cancer*.

Their conclusions are based on analysis of 1,000 cases, "random samples from the Memorial Hospital in New York City and the Lendrum Tumor Clinic of the Patterson General Hospital, N. J., during the past ten or fifteen years."

Asserting that "many cancers are curable if treated in time," these physicians set three months as the longest period that should elapse between the first appearance or discovery of possible cancer symptoms and the first visit to a physician. They call this reasonable delay; anything over three months is "undue delay."

In the cases they studied, the patients were responsible for nearly half of the delays before starting treatment. Patient and physician were both responsible for another 18 per cent. of the delays. The physician alone was responsible in 17 per cent. of the delays, and in about one fifth of the cases, 20.7 per cent., there was no delay.

In the case of the physician's responsibility, Drs. Pack and Gallo set one month as "ample time for a physician to make a diagnosis or refer the patient to a clinic." They analyze the physician's responsibility, however, on the basis of the action taken by the first physician the patient consults. The important thing is that he should recognize the seriousness of the condition and send the patient immediately to a cancer clinic.

Five types of error which physicians may make, with the result that the patient does not get treatment started until too late, are: wrong treatment; wrong advice; no treatment and no advice; acceptable treatment but with delay in referring the patient to a specialist when no improvement results; and inability to diagnose the condition within a month.

Ignorance of the seriousness of the first symptoms, fear, unwillingness to face the truth and sometimes financial circumstances are the reasons why patients delay seeking treatment.

NITROGEN AND WEIGHT GAIN OF CALVES

PRACTICAL results of great importance to the livestock industry may come from experiments at the University of Wisconsin, in which it has been shown that calves can gain weight on forms of nitrogen not supposed hitherto to be digestible and assimilable by animals.

The work was done by Professor E. B. Hart, H. J. Deobald and Dr. G. Bohstedt. They used four male calves. One of the animals was kept on a low-protein ration, as a control. Another was used as a second control, receiving a conventional ration of milk protein in addition to the low-protein ration. The other two received supplementary diets of simple nitrogen salts; the first getting ammonium bicarbonate and the second urea. These are the salts supposed to be of no value as stock feed. Yet the animals

did gain weight on them, 105 and 110 pounds, respectively, in 14 weeks. This was intermediate between the small gain (65 pounds) shown by the low-protein calf and the high gain of 126 pounds by the calf receiving the milk protein.

What caused this gain is a physiological riddle for which the three experimenters do not at present venture an answer. It may possibly be that bacteria in one part of the calf's multiple stomach transformed the simple compounds into more complex ones, digestible by the animal. Then, when the bacteria passed on into another section of the stomach, digestion may have occurred in the ordinary way. But this explanation is as yet only conjectural.

It will be necessary to carry on more extensive feeding trials before the full economic possibilities can be developed. However, at least three lines of possible significance are indicated: (1) Livestock probably benefit from the increased nitrogen content which fertilization produces in pasture grasses, quite apart from their higher protein content and better yield. (2) The feeding value of the newly developed silage made from alfalfa plus molasses may not be seriously injured by the breakdown of part of its protein into ammonia compounds, through bacterial fermentation. (3) It may eventually be found practical to use such relatively simple nitrogen compounds as ammonium bicarbonate and urea to replace part of the higher-priced protein supplements in present-day stock rations.

SELENIUM IN THE SOIL AND VOLCANIC ACTIVITY

SELENIUM, the poisonous element named for the moon, that wreaks havoc on livestock in the West and may cause "rheumatism" in human victims, is the unwelcome gift to the soil of volcanic eruptions in the remote geologic past. This has been determined by investigators of the U. S. Department of Agriculture, working for several years on the difficult problem presented by stock poisoning occurring in certain parts of the West. Chemical analyses of soils from all over the world indicate that there is no soil entirely free from selenium, though relatively few soils contain enough to be dangerous.

The dangerously seleniferous soils in this country are found mainly in the Great Plains region. They were formed by the weathering of shales deposited during periods of intense volcanic activity when the Rocky Mountains were formed. The selenium was not placed directly in the soils by the volcanoes. The poisonous element was spewed into the air and brought down to earth by rain. The clays were subsequently buried and hardened into shale. Later, the shale beds were exposed again, and weathered back into soil. Analyses of soils from Hawaii indicate this air-to-earth route of volcanic selenium.

Selenium causes mischief to livestock when the animals eat plants that have absorbed the poisonous element from the soil. Not all plants absorb it equally. Two members of the pea family, a vetch and a loco weed, are especially serious offenders. Most native grasses, on the other hand, have very low selenium contents.

Animals native or long naturalized in a given region somehow learn that seleniferous plants are not good for them and come to avoid them. Unheeding immigrant animals

mals are as a rule the principal victims. The first written record of selenium poisoning was made by Marco Polo in western China about 650 years ago—though of course he didn't know what it was. He only noticed "a poisonous plant growing there, which if eaten . . . has the effect of causing the hoofs of the animals to drop off. Those of the country, however, being aware of its dangerous quality, take care to avoid it." The present researches were conducted by Horace G. Byers, John T. Miller, K. T. Williams and H. W. Lakin, of the Bureau of Chemistry and Soils. It is reported in U. S. Department of Agriculture *Technical Bulletin* No. 601.

NEW WATER-PROOF TRANSPARENT WRAPPING FILMS

AN invention patented posthumously may bring marked changes in the transparent wrapping films industry. The new wrapping film, described in a patent just issued to the estate of Deane C. Ellsworth, Wilmington, Del., is a glass-clear, moisture-proof and water-insensitive material. It promises to find a wide variety of uses now performed by Cellophane and other similar transparent films.

The major new quality of the film, states the patent, is the fact that it can stand actual immersion in water for long periods without losing its moisture-proof properties. Present-day transparent films are moisture-proof to a large extent but can not retain this property long when in actual contact with water. In wrapping butter, cheese and other dairy products, moisture or wetness loosens the wax backing of the cellulose film and soon makes it unfit for service. That is why most butter is still wrapped in waxed paper and not in transparent films.

The late Mr. Ellsworth's patent, assigned to the E. I. du Pont de Nemours Company, is based on "the surprising and apparently irrational discovery . . . that a slight etherification of the cellulose caused wax coating compositions to adhere to the extent necessary to produce a desirable water-proof wrapping tissue. This discovery was all the more incredible because it was known at the time that partially etherified cellulose was more water sensitive than regenerated cellulose itself." Thus the etherification of the cellulose film enables the water-proof waxy compounds to stick tenaciously to it, and brings about a superior wrapping film. The Ellsworth patent, having 16 basic claims, listed in detail the preparation of 39 different formulae for making different kinds of water-proof film. Some of these films withstand a month of actual immersion in water before the water-proofing layer separates from the cellulose film back.

ITEMS

AN overlooked specimen in the Field Museum of Natural History has turned out to be a rarity, never before known—a fossil crocodile with horns. The horned crocodile fossil was collected by the Field Museum Paleontological Expedition of 1937 but its unique character was unnoticed during the collecting in the field. Only when the specimen was being prepared for exhibit did its extraordinary aspect come to light. A horned crocodile, states Henry W. Nichols, chief curator of geology, is more rare

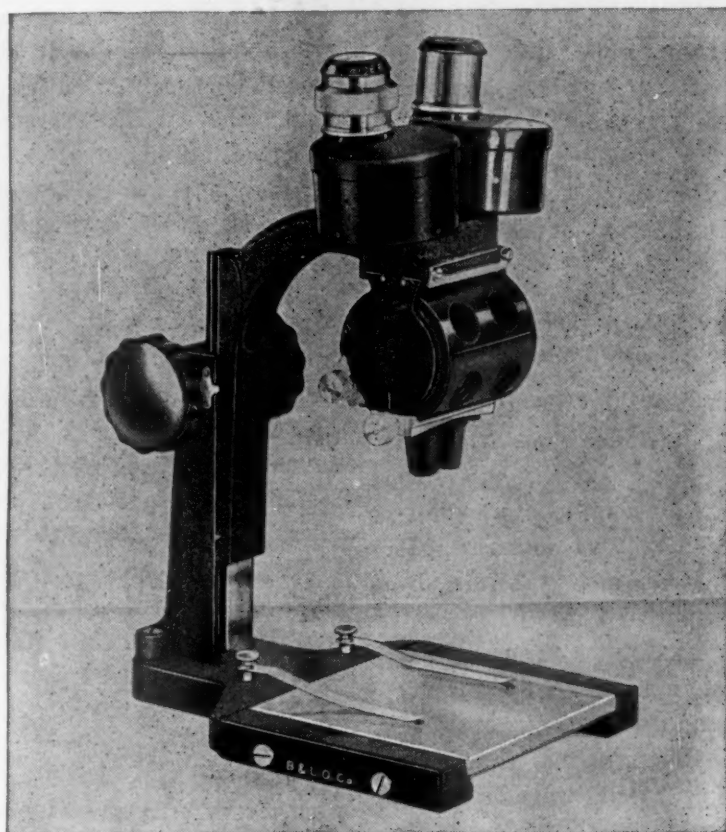
than a toothed hen, for while some prehistoric birds have been found to have teeth, there is no previous record that the order of Crocodilia ever possessed horns.

ULTRA-VIOLET rays, known to have great influence in bone formation, appear to be as influential in the growth of deers' antlers, from the researches of Professor N. Schuhmacher, of the University of Innsbruck. Professor Schuhmacher found that the antler growth of deer in the Austrian Alps was greatest in years showing the largest number of sunny days and average temperatures above normal.

LIGHT from different types of lamps in regular commercial use has quite different effects on the growth of plants, Dr. J. Voss, of the Kaiser-Wilhelm Institute, found, in experiments aimed at discovering the most efficient and economical source of artificial light for use in greenhouses. The best development of plants, he discovered, occurred under ordinary 500-watt nitrogen-filled metallic-filament lamps. Results almost as good were obtained with neon tubes. High-pressure mercury vapor lamps gave the plants a good start, but then permitted them to lag. Sodium vapor lamps produced inferior results, and the unfiltered rays of the quartz mercury-vapor lamp were definitely harmful.

ALTHOUGH the fires have not yet been extinguished, plans are already under way to salvage, in every possible way, all the burned timber in the great forest fires of the Pacific Northwest. Fifteen thousand, five hundred acres of land, containing 265,000,000 board-feet of timber with a normal value of about \$400,000, have already been seared by the flames. But, although charred, much of this timber can be cut up and used if it is removed promptly before decay and before it is attacked by insects. Fred W. Johnson, commissioner of the General Land Office, has already issued instructions to regional foresters for prompt salvage of the timber and for quick reforestation. Much of the burned land is outside the National Park areas and is in revested Oregon and California railroad grant lands. These O & C lands, as they are known, comprise a total of 2,500,000 acres under the administration of the Department of the Interior.

LONG BEACH, Calif., has been pronounced the "oldest" of America's large cities, with San Diego a close second. These two are the oldest from the standpoint not only of the date of settlement but of the age of their residents. Statisticians of the Metropolitan Life Insurance Company report that almost one tenth—9.2 per cent.—of Long Beach's population is over 65 years old. In San Diego the proportion of residents over 65 years is 9.1 per cent. All the Pacific Coast cities have old populations. An equable climate and facilities for rest and recreation attract old people who have retired and are able to live on their income. For the same reason, the highly industrialized city of Gary, Ind., is the youngest of all the nation's cities of over 100,000 population. Only 1.7 per cent. of its inhabitants are over 65 years old.



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SCIENCE NEWS

Science Service, Washington, D. C.

THE MILKY WAY

EARLIER indications that a tremendous, low-density globe of scattered stars surrounds our own disk-shaped galaxy, the Milky Way, are being confirmed at Harvard Observatory, according to a report given by Dr. Harlow Shapley to the meeting of the International Astronomical Union in Stockholm.

According to preliminary calculations, this great globe has a diameter of the order of 80,000 light years, stretching out 40,000 light years both above and below the Milky Way disk. The diameter of this disk, which contains nearly all the stars of the system, is of the order of 100,000 light years.

The astronomical yard-stick used for these investigations, Dr. Shapley explained, was the magnitude, or brightness, of more than 2,000 cluster-type Cepheid variable stars which have been studied in all parts of the Milky Way. Since all stars of this type have the same candlepower—about 200 times that of the sun—their brightness as seen from the earth is an excellent measure of their distance. Harvard astronomers have found measurable numbers of these flickering stars as far out as 40,000 light years from the earth, Dr. Shapley said. These are apparently close to the outer edge of the Milky Way globe. The spatial distribution of the stars, he added, is such that there is no doubt that these distant stars are members of the Milky Way system. Most of the 2,000 stars studied in the research were discovered for the first time on Harvard plates during the course of the investigation.

Announcement of this new cosmic information was made by Dr. Shapley during a report before the Astronomical Union on Harvard's work in investigating the distribution of galaxies and the adsorption of light in the Milky Way. He also outlined one of the observatory's current projects—an attempt to determine the dimensions of the Milky Way system by comparative studies of variable stars and external galaxies seen through the "window" in the southern Milky Way. Already 400 new variable stars have been found in this area, and a concurrent study has been made of the distribution and brightness of some 700 external galaxies in the same field.

THE INTERNATIONAL CONGRESS OF ANTHROPOLOGICAL AND ETHNOLOGICAL SCIENCES

To the International Congress of Anthropological and Ethnological Sciences, in session at Copenhagen, man is a creature that has been struggling with civilization for something like a million years. They can't even say whether the first million years will prove the hardest. Most investigators would say that present civilization is an improvement over rude discomforts and ignorance of the Old Stone Age.

Topics chosen for discussion at the congress include:

1. How civilization is influencing character. This is a psychological question of obvious future significance.

2. What anthropologists mean by that little word "race," which has attained life and death importance to many people.

3. What relationship the scattered fossil bones that represent early man have, one specimen to another. Our early ancestors are still the world's biggest detective mystery.

4. Newest theories regarding the beginnings of farm crops and taming of domestic animals. These events, which went unrecorded in their time, have a bearing on agricultural science.

Americans contributing to the congress include Dr. Frans Blom, of Tulane University; Henry B. Collins, of the U. S. National Museum; Dr. Henry Field, of the Field Museum, and Dr. S. K. Lothrop, of Peabody Museum of Harvard University.

PLANT ROOTS AND PLANT TOPS

Roots have been recognized as the supporters of plants since time immemorial. What the tops of plants do toward the support of their roots is now beginning to be made manifest.

Dr. William J. Robbins, of the New York Botanical Garden, and Dr. Mary Bartley Schmidt, of the University of Missouri, in a joint research reported in the *Botanical Gazette*, have cultivated roots of tomato plants without any tops attached. By juggling the ingredients of the culture fluid in which the roots grow, it is possible to learn something of their basic requirements—the things which the tops must supply in return for the services of the roots.

The culture fluid is one devised by Dr. Philip R. White, of the Rockefeller Institute, who first grew roots indefinitely without any tops attached. Three essential ingredient-groups are included: several mineral salts, cane sugar and yeast extract. Omit any one of the three, and the roots refuse to grow.

Drs. Robbins and Schmidt have found that they can substitute vitamin B₁ for the yeast extract and still obtain root growth. They can even substitute an organic fraction of the vitamin, known as thiazole, and get the roots to grow. This makes it apparent that the green top of a plant must supply vitamin B₁, or at least its vital ingredients, to the roots.

The mineral salts in the solution are essentially those found in a normally balanced soil solution and absorbed directly by the roots. Root-and-top relationships therefore do not come into the picture here.

Sugar must be supplied to the isolated roots in the cultures, and since the green tops are par excellence producers of sugar the necessity of this line of supply is easily seen, though the mechanism of the transfer in the living plant may not be so easily understood.

Dr. White has always used chemically pure cane sugar in his culture fluid. Drs. Robbins and Schmidt followed this practice in most of their experiments, though they did find that roots could use other sugars, such as dextrose and levulose, and that an "impure" brown sugar gave better growth results than the highly purified cane sugar.

PLANT HORMONES IN AGRICULTURE

HORMONE dust promises to speed agriculture in field and garden, as the result of investigations of the Canadian National Research Council. Synthetic chemicals that grow roots on seeds and slips of plants many days before they otherwise would sprout are now ground into talc and other inert dusts for easier and more effective application.

Experiments of Dr. N. H. Grace are being extended this year to large field trials of actual grain production in various parts of Canada.

The use of chemical stimulants, plant hormones, is not new. For the past few years scientists and gardeners have been using naphthylacetic acid, indolylacetic acid and indolylbutyric acid, all synthetically made from coal-tar and other substances, for getting roots started faster and more vigorously. Roots can even be made to grow where they would not normally appear.

The Canadian improvement is in the manner of application. Instead of putting the hormone chemicals in water and applying them that way, they are distributed in fine dust. It is easier to roll the seeds in the dust and stick the cuttings in fine powder. Wheat on the western plains may be able to get its roots in the soil faster and more securely if the seed wheat is dusted with hormones. In some cases this may mean the difference between getting a crop and not getting it. Winds are likely to blow the young sprouting seeds out of the ground if the roots do not anchor them speedily. Since the treatment causes the roots to "dig in" promptly, wheat so treated may withstand wind and drought at an earlier time after seeding.

Farmers already dust their seed with poison to kill fungus, and it is only necessary to add the hormone to the dust previously used. Demand is reducing the cost of these synthetic chemicals, and naphthylacetic acid costs about \$10 per pound. Seed for several thousand acres can be treated with a pound. Thus the treatment costs only about a half cent an acre.

Pioneers in plant hormone research were Drs. P. W. Zimmerman and A. E. Hitchcock, of the Boyce Thompson Institute for Plant Research, Yonkers, N. Y., who in 1935 showed that some 16 new chemical substances would grow root "whiskers" upon plants, even in the most fantastic places, such as upon the flowers. They applied their chemicals as solutions in water or as salves.

Extraordinarily small amounts of the chemicals are needed. For instance, naphthylacetic acid is effective in a water solution containing one part per hundred million, and a single pound of it would make ten train loads, with each train of 100 tank cars, and every car containing 12,500 American gallons.

WATSON DAVIS

LEPROSY

LEPERS as a rule don't die of leprosy. What do they die of? The National Leprosarium in Carville, Louisiana, this past year has lost 36 patients, and only 11 died of the disease that brought them inside hospital walls. The rest were taken off by tuberculosis, pneumonia and other maladies.

The forthcoming annual report of the U. S. Public Health Service medical officer in charge of the hospital

contains other facts that most people would not know about leprosy: Men are much more susceptible to leprosy than women: one of the unsolved mysteries of the disease. Patients' outgoing mail is sterilized. Practically all patients—there are 349 of them—take some kind of treatment. Most of them get chaulmoogra oil. Every patient is photographed on admission and later when indicated. The skin and features of lepers are so often affected that pictures are valuable case records. Every patient is examined each month for the characteristic germ of the disease. A patient must have a negative record for a year before he can be paroled from the hospital. Disease of the liver has been found after death in almost every autopsy at the hospital. Yet leprosy patients generally seldom complain of liver trouble. This may be a clue to some mysterious feature of leprosy. It may link with changes in the lipid content of the blood found in lepers, possibly the cause of allergic skin conditions in these patients.

Blindness is frequent among lepers. Orderlies in the hospital are patients well enough to help others. Golf, baseball and tennis are among the sports enjoyed by more active patients. A new line of treatment to restore lost sensation and motion to fingers and toes of patients is reported very promising. Described as a "positive and negative pressure apparatus," the device is helping patients whose circulation does not respond to other treatment.

THE NEW AERONAUTICS AUTHORITY

MEMBERS of the new Civil Aeronautics Authority, which on August 23 takes over the regulation of America's airways and the planes that fly them, were sworn in on August 8. For a few weeks now the Bureau of Air Commerce has been marking time pending formal transfer of its jurisdiction to the first single agency formed to deal with aviation.

A multitude of problems, including that of selling itself to some sections of the aviation industry that have turned critical eyes toward the new five-man commission and the three-man safety board because some of the appointees are suspected of having won their places on political grounds, confront the authority.

Among the general problems the new authority will have to be on the alert to protect the industry from its rivals—other forms of transportation, for example. It will also have a battle on its hands defending aviation's vital radio needs from the demands of powerful interests that have always been after more radio space. A sharp struggle appears inevitable when aviation radio range broadcasting's expected change to the ultra high frequencies is due, for television also needs the ultra high frequencies and lots of them.

A major function of the new authority will be the building of public confidence. The fact remains that the immense majority of Americans who can afford to fly do not. They have not yet accepted the fact that the commercial airlines are nearly as safe as the automobile. A major job will be safety promotion. The greatest spur to safety in the air thus far has been, in fact, the general unwillingness of people to take the same chance in the

air that they do on the ground. Lamentable as this attitude may appear to the air-minded, it has nevertheless served a useful purpose in spurring airlines and manufacturers to even more intense safety work. The new safety board and its staff of investigators can do aviation and the public a service by thinking twice before personnel is blamed for accidents—a frequent practice in the past. It can and should start with the assumption that men make mistakes and will continue to make them and that a large part of the safety job consists in developing and using instruments and machines that go wrong far more seldom than mere human beings.

An additional heavy responsibility, shared with the Securities and Exchange Commission, is to see to it that the tragic financial history of the railroads is not repeated at the expense of future air travelers and investors. Recent difficulties of the merchant marine and the railroads, it is stated, can not be blamed entirely on decreased traffic to-day. In many cases, particularly in the case of the railroads, the difficulty can be laid at the feet of operators who in past years engaged in unwise overexpansion and in many cases indulged in practices now outlawed. Provisions looking toward prevention of this are worked into the laws creating the SEC and the new CAA.

LEONARD H. ENGEL

THE NEW CURTISS-WRIGHT 30-PASSENGER TRANSPORT PLANE

MARKING the entry of a fourth company into the large transport manufacturing field, a new Curtiss-Wright 30-passenger twin-engined airplane will be ready for its initial flight before the end of the year. Now in the jigs at a factory in St. Louis, the new plane, breaking with the Boeing and Douglas policy of putting four engines on large passenger planes, embodies a number of novel construction features, according to T. P. Wright, director of engineering of the Curtiss-Wright Corporation.

Designed to accommodate 30 passengers by day or 20 by night, the ship is not to be compared with planes such as the 42-passenger DC-4 or larger size planes now on the drawing boards. Size has been kept down so that airlines using the ship will be able to feature frequency of service.

Two engines developing 1,600 horsepower at take-off and 900 horsepower when cruising comprise the power plant of Model 20, as it is known. The design is such that 2,000 horsepower engines, now under development for the U. S. Army Air Corps and expected to be commercially available a year after the first Army planes are equipped with them, can be used on the plane.

Gross weight of the plane, which will have a 108-foot wingspread and a length of 76 feet, will be 36,000 pounds. It will cruise at 200 miles an hour at 10,000 feet. Like both of the other new large landplanes now nearing commercial use, the C-W 20 will be equipped with a pressurized cabin to keep atmospheric pressure above that of the rarefied atmosphere through which it will fly.

Although Mr. Wright makes no such statement or inference, it is believed that an underlying motive behind design of the plane is the belief that the larger planes already in existence and the still bigger ones planned will prove uneconomical and that the 30-passenger plane size will prove the most satisfactory.

ITEMS

A PREHISTORIC dog that threw in his lot with mankind over 7,000 years ago is attracting attention at the International Congress of Anthropological and Ethnological Sciences. The dog's remains are pronounced the oldest of any domesticated dog known. They are Maglemosian, an era of transition in northern Europe, when mankind shifted from the Old Stone Age into the more enlightened New Stone Age. This happened 7,000 to 5,000 B.C. Dogs are considered the first animals domesticated by man.

STRANDED for a million years or more on a "lost world" plateau in the wild interior of Venezuela, hitherto unknown animal and plant species have been brought to this country by an expedition sponsored by the American Geographical Society. In the current issue of the *Geographical Review*, G. H. H. Tate, of the American Museum of Natural History, gives the first report on the work of the Phelps-Venezuelan Expedition. The area visited is a high tableland known as Auyantepui, cut off from the rest of the world by its high, rocky, precipitous sides and by a wide surrounding belt of dense jungle and is only about 100 miles from Mt. Roraima. The animals found on top of Auyantepui for the most part are relatively small, including ant-eaters, opossums and wild rats and mice. They and their ancestors have been marooned on the plateau since early in Ice Age times—something between one and two million years.

THE AMERICAN STANDARDS ASSOCIATION has set up a coordinating committee to lead in the establishment of new and revised automobile and traffic standards. Spurred by the rapidly spreading requirement for periodic inspection of automobiles, the committee will draw up inspection standards for brakes, tires, lights, alignment, accessories and other auto equipment. Among a large number of other projects, it will revise the traffic signal code. It is explained that there is a growing tendency in the automotive industry to deviate from the national standard shades of green, red and yellow used in traffic signals.

A HINT has been obtained that too great accumulation of phosphorus has something to do with leukemia, which is an overgrowth of the white blood cells and one of the deadliest diseases known. Dr. John H. Lawrence, assistant professor of medicine of the University of California, has found that bones, liver and spleen, in which leukemia cells concentrate, exchange a much higher percentage of radioactive phosphorus than do normal cells. The radioactive phosphorus was artificially manufactured in the atom-smashing cyclotron at the university. In effect, this radioactive phosphorus is "tagged" by its radioactivity and the increase of radioactivity in the various parts of the body gives a method of determining how much phosphorus they absorb and a new method of studying the abnormal metabolism in this disease. Mice were used as experimental animals. The selective concentration of phosphorus in the leukemic mice may make possible treatment of the disease by artificial irradiation taken into the body by the phosphorus. At present, however, the experiments will be confined to mice. No successful treatment for leukemia is known, but success in producing the disease in mice, recently achieved, opens the door to experimentation.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE INTERNATIONAL PHYSIOLOGICAL CONGRESS AT ZURICH

CANCER and its causes are up for discussion at the meeting of the Sixteenth International Physiological Congress, which opened in Zurich on August 15. While politicians and military leaders eye each other suspiciously and work at cross purposes, scientists from the same lands form a united front against a common enemy. Two prominent participants in the discussion are Americans. Dr. M. J. Shear, of the U. S. Public Health Service and the Harvard Medical School, told of his researches on cancer-causing derivatives of the chemical known as benzanthrathene. The compounds on which he worked are not known from ordinary, spontaneous cancers, but they do appear to have significance in forms of the disease produced by contact with greasy, sooty or tarry substances, such as occur in certain industries. Something in crude ether-extracted wheat germ oil, possibly a chemical relative of the same cancer-causing hydrocarbons studied by Dr. Shear, has been found guilty of producing malignant tumors in rats, it was reported by Dr. Leonard Rowntree, of the Philadelphia Institute of Medical Research. Dr. Rowntree worked in collaboration with Drs. A. Steinberg and W. R. Brown. Wheat germ oil figures importantly in present-day therapy because it is a rich source of vitamin E, the fertility vitamin; but the cancer-producing part of the oil is not the vitamin. This discovery means that scientists must search more deeply into the possibility of diet's playing a part in causing certain types of cancer.

DESPITE all the research that has been expended on the eyes, it has been possible for Professor S. Krauss, of the Hebrew University at Jerusalem, to find a hitherto unknown function for the organ of sight. The minute sensitive rods that crowd the retina, he said, have as part of their job the perception of brightness-differences in the "medium," or general background, of objects that we look at. Professor Krauss gave a demonstration of his discovery.

MUSCLES and other working parts of the body can increase or diminish the blood supply they receive according to their needs from moment to moment, quite as accurately as a householder can turn the water supply on or off. A description of the mechanism of blood supply control was presented by Professor H. Rein, of the University of Göttingen. The key to the situation is the presence of waste products of muscular activity, particularly carbon dioxide. Increase in its local concentration results in wider opening of the blood vessels, permitting more blood to reach the spot where it is needed.

At the congress, Dr. Emil Bürgi, of the Pharmacological Institute, Berne, and Dr. F. Flury, of the Pharmacological Institute, Würzburg, discussed the permeability of human and animal skins to various poisons and drugs.

Dr. Bürgi's method of investigation is very neat and exact. He puts the substance to be used in a little hemisphere of glass, open on the flat side. This is sealed securely against the skin. After a suitable time lapse, the subject's breath and body secretions are analyzed for the presence of the chemical. Alcohol, ether and chloroform, he found, penetrate the skin very easily, as also do all the aromatic oils. Some substances that will not penetrate the skin by themselves do so readily when dissolved in alcohol, acetone or other solvents; in this class Dr. Bürgi mentioned camphor, cocaine and pericaine. Some of the drugs in his experiments were tried on animals. Thus, he found that folliculin, a powerful female sex gland extract, will go through the skin of a mouse. He also used mice to demonstrate skin permeability to mercury in ointments. Dr. Flury confirmed the results of his Swiss colleague. The horny layer in the human skin is much overrated as a protection against foreign substances in solution, he stated. Poisons and drugs that might be stopped by that layer will find openings through it at the hair follicles, especially if mechanical factors or physiological stimuli are at work. Permeability of the skin is therefore something for the physician to take into consideration. On the one hand, the skin can admit poisons; on the other, it is possible to use it as a gate-of-entry for beneficial medicines.

VISUAL purple, the chemical compound that enables us to see, has been successfully extracted from the eyes of frogs in the laboratory and made to perform in the test-tube as it performs in the eye, Dr. A. M. Chase, of Columbia University, reported before the meeting of the congress. Visual purple plays a rôle in the living eye similar to that of the sensitive silver compound on a photographic film in a camera. Only it does it better, for whereas a photofilm once exposed holds the same image forever, the reaction of visual purple in the retina of the eye is reversible. That is, it receives a light-impression, transmits the story of its image to the brain, and then returns to its original state, ready for another job of looking at something. The stuff is called visual purple because it is purple except when it is exposed to light. Then it loses its color, but after a short time "regenerates" and regains its purple hue. In the Laboratories of Biophysics at Columbia University, visual purple has been changed from colored to colorless phase and back again, a feat which physiologists and chemists had for many years vainly endeavored to perform.

ANOTHER section of the congress devoted considerable attention to the effects of various drugs on heart and respiratory action. Dr. McKeen Cattell and Dr. H. Gold, of the Cornell University Medical School, presented papers on the mechanism by which digitalis relieves heart failure. Dr. H. J. Stewart, of the New York Hospital, also talked on digitalis, telling of its effect on the heart's output under various disease conditions. Dr. M. Sumwalt dis-

cussed the effects of certain morphine derivatives in depressing the breathing rate.

Food requirements, figured by nations instead of individuals or families, occupied the attention of the congress. Appropriately, perhaps, the leaders of the discussion were from the two countries now strenuously endeavoring to establish complete self-sufficiency, which would be most menaced by blockade if war should come—Germany and Italy. The speakers were Professor E. Abderhalden, of the University of Halle, and Professor G. Quagliariello, of the University of Naples. Standardization of the national diet, though desirable at least in case of emergency, is not fully possible, it would appear from the discussion. For example, individual requirements for protein may vary from person to person all the way from 25 to 300 grams a day. Some persons can substitute one kind of energy-food for another (*e.g.*, starch for fat, or vice versa) to a greater extent than others. A few generalizations, however, appeared possible. Whole wheat bread, declared Professor Abderhalden, is decidedly preferable to white bread both as a measure of national economy and for better health. Complete substitution of fat for carbohydrate, or the other way about, is impossible. It is quite impossible to lay out a strictly standardized schedule for vitamins.

ITEMS

THE rocks of the earth beneath our feet contain much more nitrogen, one of the chemical elements, than the atmosphere of the earth. This is the latest discovery by Lord Rayleigh, president of the British Association for the Advancement of Science, which opened its annual meeting at Cambridge on Wednesday. Lord Rayleigh, an authority on the physics of the earth, has investigated in granite and other rocks the amounts of elements usually thought of as occurring in the air. The results are contrary to what has been supposed. The total amount of nitrogen in the earth is many times more than in the atmosphere. If the earth's mass consists of about 65 per cent. rock as has been estimated, the rocks contain 37 times as much nitrogen as the atmosphere. This fact is expected to have a bearing on theories as to how the earth was formed.

THE vast clouds of dark matter in interstellar space, that obscure some stars and redden the light of others, are composed largely of iron and aluminum, according to Dr. B. Sticker, of the observatory at Bonn. He estimates the diameter of particles as averaging one ten thousandth of a millimeter, or one two-hundredth-thousandth of an inch. Dr. Sticker agrees with astronomers in the United States in the opinion that this dark, "unorganized" matter in space makes up a very considerable fraction of the material universe.

THE stratosphere contains a great deal more of carbon dioxide than it theoretically should. This gas, a by-product of life activity, should have its greatest concentration near the surface of the earth and should diminish rapidly with increasing altitude. Actually, Professor N. Regener,

of Stuttgart, has discovered by analysis of upper air samples captured by means of high-flying robot balloons, the carbon dioxide content of the atmosphere at 18 miles elevation is only five parts in 100,000 less than it is at the surface. Constant mixing by vertical air currents is credited with this unexpectedly even distribution of carbon dioxide.

LISTENING to a new explanation of the old phenomenon of phosphorescence, investigators attending a Stanford University summer conference on photochemistry, heard the words "exciton" and "phonon" as new descriptive terms applied to subatomic particles whose behavior under certain conditions produces phosphorescence. Light may excite two kinds of energy when it strikes a solid body, Dr. Teller, of the George Washington University, believes. It may excite electronic energy, the moving particles thus resulting from the impact of the light being defined by the scientist as an "exciton." A particle vibrating from the other type of excitation for which he holds light responsible Dr. Teller calls a "phonon."

DRILLED in utmost secrecy and with the application of several new methods, the first oil well ever drilled inside the levee of the Mississippi River has begun to produce oil in St. James Parish, La., from a deposit more than 6,000 feet below the river. More than 200 barrels of oil a day are coming from Realty Operators No. 1, a well drilled for the Continental Oil Company. Digging of other wells on river bottom land inside the walls that protect the countryside and systematic tapping of the pool below the river is expected as a result of the success of the well. Forty-foot pilings had to be driven into the river bottom land to support the drilling rig and plank boarding had to be laid over the mud to transport tools and supplies. The well is producing through tubing perforated from 6,358 to 6,364 feet. More than 4,100,000 cubic feet of natural gas are also being produced daily.

DR. F. L. WELLS, of the Harvard Medical School, has discovered that spiders can hear at least some of the sounds audible to human ears. He tested a number of species of orb-weaving spiders, the kind that make the handsome wheel-shaped webs, using a tuning fork of medium pitch, held close to them but not touching them. The spiders showed various responses, ranging from slight movements of the legs to attacks upon the fork itself, as if it were an insect. Most interesting was the reaction of some of the species, which made their webs vibrate or dance violently. The individuals that attacked the tuning fork swathed its end in loops of silk and tried to bite it.

PHOSGENE, the deadly war gas, has been harnessed to the service of medicine by combining it with sex hormones and other glandular products, which are rendered ten to fifteen times more powerful when thus combined. The process of producing these phosgene-hormone compounds has been patented in Germany by the discoverers, Dr. Lorenz Ach, of Mannheim-Waldhof, and Dr. Wilhelm Dirscherl, of Frankfurt-am-Main.

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SCIENCE NEWS

*Science Service, Washington, D. C.*SOME PAPERS READ BEFORE THE
CAMBRIDGE MEETING OF THE
BRITISH ASSOCIATION

BY WATSON DAVIS

Director, Science Service

LORD RAYLEIGH, president of the British Association for the Advancement of Science, in his address at the opening of the annual meeting, declared pessimistically that "the world is ready to accept the gifts of science to use for its own purposes, but it is difficult to see any sign that it is ready to accept the advice of scientific men as to what those uses should be." Disagreement with their leader's pessimism is already being registered, however, by many British scientists, as well as by some of the foreign visitors at the meeting. A surprising number of the more optimistic scientists hold that there is a growing movement among leaders, showing solid determination that scientists shall have a say regarding the utilization of the riches they bestow upon civilization. It is probable that scientific liberals will demand more than mere fact-finding rôles for themselves and insist that political and economic leaders take scientific advice in running the world. Lord Rayleigh challenged the idea that science is responsible for application of its own discoveries to the purposes of war. He pointed out how the chief of staff of the British Army in 1908, five years after the successful flights of the Wright brothers, had scorned aviation as of no military value. He stated that, "The application of the fundamental discoveries of science to the purposes of war is altogether too remote for it to be possible to control such discoveries at the source."

DISCOVERY of the second example of a new kind of immense but extremely faint star system in the heavens was the subject of a paper by Dr. Harlow Shapley, director of the Harvard Observatory. Only a few months ago Harvard astronomers found the first of these systems, called the Sculptor cluster, on a photograph made with the southern hemisphere's most powerful telescope, the 60-inch reflector at Harvard's station at Bloemfontein, South Africa. The new star cluster is in the constellation of Fornax, only about 20 degrees in the heavens from the Sculptor cluster. It is an immense aggregation of stars probably about 300,000 light years distant from us. Dr. Shapley said that at least 5,000 individual stars in the Fornax system have been spotted. The reason that astronomers are rather excited about these discoveries is that they have found a new kind of star grouping that "may have high significance in the general study of the nature of stellar systems." It is remarkable in that it is neither a globular cluster, nor a Magellanic cloud, nor a spheroidal galaxy, but has certain properties of all three of these well-known kinds of stellar systems. The extreme faintness of the great mass of stars is one reason that it has not been discovered earlier. It took a two-hour exposure with the powerful telescope to demon-

strate the existence of the Fornax cluster. Doubt that the universe is expanding, Dr. Shapley hinted, may result from the extensive study of the distribution of the galaxies that Harvard Observatory has been conducting for several years. There are major inequalities in the way the great "universes" of stars, each somewhat like our own Milky Way, are distributed in space. Dr. Shapley reported the discovery of a transverse gradient in the space-density of galaxies across the south galactic pole. As a result of this work the scientific controversy as to whether the universe is expanding may be renewed.

PROFESSOR W. H. FURRY, of Harvard University, spoke on the heavy particles of about 200 times the weight of the unitary electron, that get knocked dizzy by occasional incoming cosmic rays, describing how much (or how little) physical research has thus far disclosed about these elusive citizens of the sub-atomic world. There do not seem to be many of them, at least in the rather widely scattered parts of the earth where cosmic ray research goes on, for of the thousands of photographs that have been taken of particle collisions only a few have shown these heavyweights being jostled about. Of course, nobody ever sees or photographs the particles themselves. But when cosmic rays are permitted to dash through a partial vacuum containing a little water vapor, the electrically charged particles they hit fly off at an angle, leaving behind a trail of white mist, and this can be seen and photographed. It is something like a skyrocket—you can not see the rocket itself, but you know where it goes from the trail of sparks it leaves behind. The weight of such particles can be quite accurately estimated by applying the field of a strong magnet, and measuring the amount by which they are pulled from their course, just as you could tell the difference in weight between a tennis ball and a baseball by throwing them both across a strong wind. The mass or weight of the newcomers in the field of atomic physics has been worked out by such methods as about 200 times that of the well-known and far more abundant electrons.

WE could learn about cosmic rays much more rapidly if it were not for the unfortunate circumstance that the earth has an atmosphere. Professor E. Regner, of the Stuttgart Technical College, told of some of the troubles introduced by the presence of such a lot of air over the earth. "Unfortunately there are great experimental difficulties in the exact measurement of cosmic rays at great heights," he said. "Nevertheless it is firmly established that a transition effect exists at the limit of the atmosphere, which is shown by a detectable maximum in greater heights." The sun's behavior is another disturbing element. When Old Sol stirs up a magnetic storm on earth with a burst of unusual activity in his own massive body, there is a corresponding increase of cosmic ray activity at greater altitudes on earth, while at the same time, paradoxically enough, the cosmic ray activity at sea-level diminishes.

THE first understanding of exactly what happens within the hearts of atoms, showing that they get hot and bothered and finally go smash, was presented by Dr. Niels Bohr. When the nucleus or heart of an atom is subjected to bombardment with electrical particles, the events resemble on a small scale what happens when you heat up an ordinary larger object. At first, energy is added and a semi-stable compound nucleus is formed. Then the whole thing either goes to pieces or de-activates itself by radiating away the energy that has been shot into it.

COLD normally makes liquids thicker and more viscous, until at last they solidify: "slow as molasses in January" is a traditional expression of this fact. Dr. J. F. Allen, of the University of Nebraska, reported that one form of liquid helium, which is so cold that a January blizzard seems like a furnace blast by comparison, flows thinner than water. This form of helium (designated by the symbol HeII) approaches absolute zero in temperature. Absolute zero is 273 degrees Centigrade below freezing point. HeII offers so little resistance to stirring or pouring that it resembles a gas in this respect rather than a liquid. Thus far, Dr. Allen stated, no comprehensive theory has been developed to explain all its properties.

THE love philtres of old-time alchemists have their counterparts in synthetic compounds produced by modern chemists. Substances not at all related to the natural sex hormones stimulate normal sex reactions, according to a report made by Professor E. C. Dodds, of the University of London. He was able to produce characteristic physiological changes in female animals with a whole series of organic compounds which he made in the laboratory. This "indicates that a complete change of view must be made on the question of the specificity of biological action," he remarked, adding, "The bearing of this on the whole question of hormones and vitamins is of the greatest importance." In line with Professor Dodds's suggestion, it appears possible that chemists may eventually be able to produce synthetically substitutes for the present costly and laboriously extracted "biologicals" much used in medicine that will cost far less and yet be much more potent. Dr. A. S. Parkes, also of the University of London, cited examples of male gland secretions, or hormones, that also had the power of stimulating underdeveloped female animals to normal growth and activity along the lines of their own sex. This falls in line with the lack of specificity in such substances discussed by Dr. Dodds.

ISLANDS played a classic rôle in the development of the doctrine of evolution. Darwin was impressed with the effects on animals and plants of ages of isolation on the Galapagos; similar phenomena on the smaller islands of the East Indies had a like effect on the mind of Alfred Russel Wallace. But isolation can produce evolutionary effects without any islands, it was pointed out by several speakers before the association. Animal and plant communities can be surrounded with conditions on land that

prevent their migration just as surely as though they were marooned in the midst of the sea. For example, a forest may be surrounded by grasslands which many of its species are quite unable to cross, or Alpine species may be isolated if the mountain range is in the midst of a desert. The effects of this kind of isolation, termed "ecological isolation," were discussed by Dr. W. B. Turrill, of the Royal Botanic Gardens at Kew. An even narrower isolation is possible, when the nature of an organism, or the minute interior structure of its cells, prevent it from interbreeding with species that surround it and are somewhat like it, but not sufficiently so to permit successful mating and reproduction. These types of isolation, known, respectively, as genetic and chromosomal isolation, were the topics of Dr. C. D. Darlington, of the John Innes Horticultural Institution, and Dr. D. G. Catcheside, of King's College, London.

CIVILIZATION'S dawn—the time when men learned how to systematize production and live in towns—recedes farther and farther into the midst of years the longer the problem of culture origins is studied, it was indicated in the address of Professor V. G. Childe, president of the section on anthropology. Recent German excavations in lower Mesopotamia show well-developed town life as far back as 4,500 B.C.—long before the invention of writing. And the towns found buried beneath the ancient river plain show every evidence of having been built by peoples already civilized, who apparently migrated into the land from somewhere else, bringing their relatively advanced culture with them. Evidence also increases that there was a continuity of civilizations, with business and cultural contacts between the peoples, during all these uncounted centuries of unrecorded history. Archeological finds all the way across Europe, from Macedonia to Scandinavia, give indications of these contacts far back into the Late Stone Age. East met West ages upon ages ago.

NATIONAL hoards for emergency purposes are already showing a tendency to take the form of food reserves rather than gold reserves, it developed in discussion by J. M. Keynes, C.B., of the University of Cambridge. As he summed it up: "It is an outstanding fault of the competitive system that there is not sufficient incentive for the storing of raw materials so as to average periods of high and low demand, except by means of excessive price fluctuations. There is, therefore, a *prima facie* case for government action to supplement this deficiency, which is not easily supplied by the competitive system from within. In present circumstances three considerations combine to reinforce this *prima facie* case: (1) storage for war purposes; (2) with the object of mitigating the fluctuations of the trade cycle; and (3) the stabilization of prices by holding some part of the central banking reserves, not in gold, but in a composite commodity."

FARM mechanization has not proceeded as far in Great Britain as it has in the United States, but Dr. S. J. Wright, deputy director of the Agricultural Engineering Research Institute at the University of Oxford, sees its

coming to the islands without very great misgivings. He stated that "Mechanization is neither a serious menace to our rural amenities nor a royal road to prosperity. Most of the changes for which mechanization have been blamed are due to purely economic causes, and, in the long run, agriculture can absorb mechanization without prejudice to its own interests. Moreover, under present conditions, only the machine can give the agricultural worker the leisure and amenities which he is entitled to demand."

WILL the great city of London become "one with Nineveh and Tyre" through lack of water? There is a definite threat of failure to the subterranean water supply, according to Dr. S. Buchan of London. "The truly artesian conditions of a century ago are gone and in one area the surface of the water stands 300 feet lower than it did sixty years ago. Water is being extracted from the center of the London Basin more rapidly than it is replenished. . . . Owing to the geological structure the lowering of the water level has caused brackish water to flow from the tidal reaches of the River Thames into the chalk and to pollute the supply in an area of high-yielding wells. As the fall in level continues, pollution will become more intense. . . . The large number of abandoned wells create another potential danger to the water supply."

AMAZINGLY "modern" is the broken skull of an exceedingly early Stone Age man discovered at Swanscombe, associated with extinct elephants and other animals that disappeared from Europe with the passing of the Ice Age. This important fossil was discussed by a group of seven scientists, who tackled the question from all possible angles. Although this earliest of Early Britons was an exceedingly crude fellow, so far as his tools and other cultural achievements are concerned, he was not a Neanderthaler, nor a Heidelberger, nor a member of any of the other clumsy, beetle-browed races we have been accustomed to regard as dominating the dawn of the Age of Man on this planet. He was like us, a member of the species *Homo sapiens*, so far as all the evidence now in hand can be interpreted.

GOLD mirrors, once supposed to be a secret of the ancients, were demonstrated to the British and foreign scientists attending the meeting, in the works of the Cambridge Instrument Company. Gold mirrors, better than queens of antiquity ever possessed, yet within the reach of the ordinary citizen's wife, can now be prepared, thanks to modern chemistry. The gold is first made up into an organic compound (something the ancients never accomplished) and then the compound is decomposed over glass, depositing the precious metal in an exceedingly thin but brilliantly shining film.

ITEMS

OBSERVATIONS at Mount Wilson Observatory have enabled scientists to determine, for the first time, the size and physical characteristics of the only eclipsing stars in outer space in which astronomers are particularly interested. An eclipsing star is really a pair of stars

that revolve around each other. An eclipse occurs each time one member of the pair passes between us and the other member. The largest star in the eclipsing system, named Zeta Aurigae, is equivalent in size to about 10,000,000 of our suns, while the smaller is also much larger than the sun. The large star is approximately 20 times the diameter of the smaller, hotter star. The largest star in the system is a giant "K" type star. The most striking feature about Zeta Aurigae is that the large star is as dense as the vacuum of an electric bulb. This information about Zeta Aurigae is outlined by William H. Christie, of Mount Wilson Observatory, who has observed the last two eclipses, in a leaflet published by the Astronomical Society of the Pacific. The eclipse occurs every 973 days, the larger star passing before the smaller. The eclipse lasts about 37 days. Mr. Christie explained that the reason for the great interest in the Zeta Aurigae eclipses lies in the fact that it is the only star known, other than the sun, in which man can actually measure the heights to which various elements constituting the atmosphere of a giant star extend.

POINTING the way toward eventual adoption of ultra short-wave radio communication by the air transport industry, month-long tests on a skyliner between New York and Pittsburgh have shown the practicability and freedom from static of ultra high frequency radio waves, according to an announcement made by the Western Electric Company. Radio waves of a frequency of 125 megacycles were almost entirely free of static in tests which covered a wide variety of test conditions. Elimination of static has been one of the major problems of aviation communication system and is particularly important during winter operation when storms are more frequent. Tests were conducted on a regular Transcontinental and Western Air transport plane, which carried its full complement of regular radio equipment while the tests were being conducted. The chief handicap to ultra short-waves is the fact that they do not travel beyond the horizon, thus limiting their effective range.

VALUABLE plant specimens in the museum of the Catholic University of America are now being protected against destruction by insect pests without having to be treated with poisonous or explosive chemicals, hitherto used in all leading herbaria. The insects and their eggs are literally cooked to death, yet without damage to the specimens. The method was devised by Dr. Hugh O'Neill, botanist on the university faculty. Dr. O'Neill puts a batch of specimen sheets into a double-walled steel cabinet lined with asbestos and fitted with a tight door. At the bottom of the cabinet is a pair of electric heaters, controlled by a thermostat. Temperature is raised to 140 degrees Fahrenheit and kept at that point for several hours. A tank of water in the cabinet prevents the contents from becoming too dry. The heat penetrates even such things as acorns and fleshy fruits and kills insect eggs and larvae within them. Since installing the heat treating cabinet, Dr. O'Neill and his colleagues have used it on nearly a quarter of a million botanical specimens. Insect depredations in the university herbarium have been stopped.

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SCIENCE NEWS

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SYMPOSIUM ON STAPHYLOCOCCI

WHEN members of the Society of American Bacteriologists gathered, on August 30, for a scheduled symposium on staphylococci at San Francisco they were really sitting down to a council of war.

The enemy under discussion consists of tiny, round germs, the staphylococci, which appear under the microscope in bunches like grapes. These bunch-of-grapes-like germs have been known for a long time as the villains that cause boils, carbuncles and similar afflictions and more recently have been identified as the cause of food poisoning outbreaks. The reason for the war council, however, is that besides causing these relatively minor if distressing conditions, staphylococci are death-dealers when they get into the blood stream.

Recent staphylococci disasters and the renaissance of chemical warfare against germ diseases since the discovery of Prontosil and sulfanilamide have turned the attention of bacteriologists back to these common germs that for many years were relegated to the background in the fight against disease.

Staphylococcemia, the scientific name for blood stream infection with staphylococci, appears to be almost one hundred per cent. fatal. That is why doctors warn laymen against picking or pressing or otherwise meddling with boils, pimples and carbuncles. The localization of the germs in the boil is the best mechanism known for keeping the germs out of the blood stream. Picking or squeezing the boil to open it is like throwing a bomb at your own fortifications. What to do if the germs do get into the blood stream is a moot question. English and Australian physicians believe that a specific staphylococcus antitoxin will cure the infection. American physicians in general do not agree.

Staphylococci do not all produce a toxin or poison. The poison that some of them produce is a more potent killer than the toxins of either the diphtheria germ or the tetanus (lockjaw) germ. An antitoxin can be made which will eliminate or neutralize the staphylococcus toxin in an infected animal, but the animal may die anyway. The death in such case is put down to the "invasiveness" of the germ.

When a boil or carbuncle forms and the staphylococcus infection is localized, the germs are destroyed by the body's large germ-eating cells, the phagocytes. Another mechanism the body has for resisting germ infection consists in the formation of antibodies, invisible substances that combine with the germ's antigen and prevent the latter from causing disease. Some authorities believe that this mechanism is helpless in the case of invasion of the body by mature staphylococci because after a certain stage in their development these germs acquire a hard protective capsule around them. The capsule, like that of the pneumonia germ, may keep the antibody from getting at the germ's antigen.

SYMPOSIA AT THE COLD SPRING HARBOR BIOLOGICAL LABORATORY

SOCIOLOGY as a human science seems to interest its stu-

dents mainly in places where life is hard—slums, tenant farms, mining and mill towns and the like. Similarly, the study of sociological condition among plants has attracted most attention in places where life for plants is hard—sand dunes, dry plains, mountain slopes, steppes and tundras. This curious parallelism between the two studies was developed in a discussion by Professor H. S. Conard, of Grinnell College, who opened a symposium at the Cold Spring Harbor Biological Laboratory on August 29. Only in a relatively few places have the sociological relationships in really stable plant communities, like those of Switzerland, received close attention. Elsewhere, and especially in America, the eyes of botanists have been attracted by stress and flux and change. Plant societies, as Professor Conard outlined them, may be exceedingly simple and primitive affairs, like the one-layered communities of lichens that cling precariously to the bare faces of rocks. Or they may be highly complex affairs, with many species arranged in a whole series of strata. The contrast is as great as that between an Eskimo village and New York City.

ANIMALS living in a close community or society are not merely individuals in themselves; they are also functioning parts of a super-individual or super-organism. This view was developed by Professor Alfred E. Emerson, of the University of Chicago, speaking at a symposium on ecology. Professor Emerson drew his illustrations principally from the organization of colonies of the social insects, such as ants and termites. Queen insects and their mates, which are the only members of the group able to produce a new generation, he likened to the reproductive organs of the animal body. The worker castes among the insects are comparable to the muscles, bones, and other general body tissues. Among the social insects, secretions produced by one individual or caste and fed to others produce changes in behavior. Similarly, in the animal body, there are the hormones or secretions produced by the ductless glands, which have effects on tissues often quite remote from the cells that produce them. Again, nerve impulses in the body have their analogue in the mysterious calls to action that can spread in a second from one end to the other of a beehive or anthill. Periods of low vitality and recovery in the individual have their parallel in the partial die-off and the renewal of the population within a colony, that come either seasonally or at less regular intervals. Just as a man may say he feels young again (and to a certain extent actually be rejuvenated), so may a colony of the social insects undergo a community rejuvenation.

THE EFFECTIVENESS OF LOW VELOCITY ELECTRON BEAMS IN KILLING FUNGUS SPORES

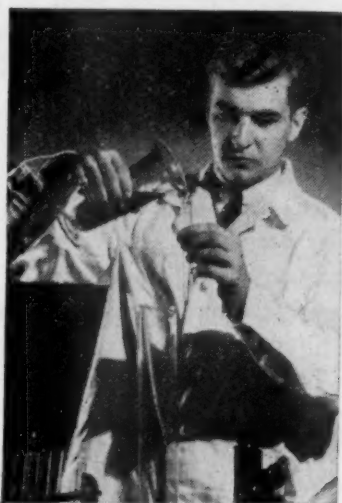
It takes more than one electron from a stream of low velocity cathode rays to kill certain types of spores, according to a study by Dr. Caryl P. Hastings from the Massachusetts Institute of Technology reported in *The Journal of Applied Physics*.

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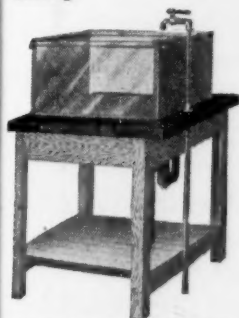
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It took specially devised apparatus, different from cathode ray tubes in general use, to find this out. Insignificant as this fact may appear on the surface, future work with his pioneering equipment and experiments may lead to important clues as to the nature and treatment of cancerous tissue.

Electrons emitted under a minimum electrical pressure of two kilovolts are necessary to achieve material effectiveness in killing fungus spores studied. Increase of the voltage and the electron dosage produced such marked effects as to indicate that the absorption of more than one electron was necessary for cell death.

The importance of the observations lies in the fact that the killing action of x-rays on cancerous and other tissues has been ascribed not to the x-rays themselves, but to the electrons within the cells which the x-rays hit and cause to bombard vital cell material. Dr. Haskins's study is one of the first making use of low-velocity electron beams to bombard living material, thus making possible quantitative determination of what takes place. Most previous work has been with high-velocity cathode rays and with x-rays.

THE NEW FLUORESCENT LAMP

THE new fluorescent lamp, candidate for the place as successor to the incandescent electric bulb, because of its promise of more and better light for less money, was discussed at the meeting of the Society of Illuminating Engineers at Minneapolis on August 30.

The new lamp works best near room temperatures and gives off much less light at abnormally high or freezing temperatures. If handled properly, it has a longer and more efficient life than the ordinary filament bulb. It gives off but one fourth as much heat as the present type of lamp and therefore is useful in connection with air-conditioned locations.

Speaking before the society, Dr. G. E. Inman, of the General Electric Company, stated that the new lamps provide better daylight illumination than the standard type of bulb, even though certain light in the red end of the spectrum is not radiated by the phosphorus used to generate the light. But the eye, less sensitive to reds than to other colors, does not notice the absence.

The new lamps require a special starting switch to set them going. They use mercury vapor through which an electric current is discharged to generate ultra-violet light which is absorbed by the fluorescent powders coating the walls of the tubular bulbs. This ultra-violet light is re-radiated as light of different colors, depending upon the particular fluorescent material with which the wall is coated.

Extreme variation in the lamp's efficiency at different temperatures was explained by J. W. Marden, N. C. Beese and G. Meister, of the Westinghouse Electric and Manufacturing Company, as being due to changes in the generation of ultra-violet light of a certain wave-length at different temperatures.

FURTHER PAPERS READ BEFORE THE BRITISH ASSOCIATION

AT the Cambridge meeting of the British Association for the Advancement of Science, in a communication pre-

sented on behalf of Dr. Robert Broom, of the Transvaal Museum, the fossil skull of a creature that might be the missing link between man and the common ancestor of apes and man, except for its geological youth, was described. The skull is that of a unique anthropoid ape found in South Africa. It is the newest member of the strange family of anthropoid apes, previous forms of which were discovered by Dr. Broom and by Professor Raymond Dart, of Witwatersrand University. These animals existed in relatively recent geologic times, contemporaneously with genuine human beings of Pleistocene or Ice Age time. Sir Arthur Keith stated that "These discoveries have destroyed the fingerposts on which anthropologists have always depended to indicate the line between anthropoid and man." Dr. Broom's latest-found skull, though distinctly anthropoid, has teeth that are human in structure and arrangement. On this point, Sir Arthur Keith remarked, "It is likely that these apes evolved more closely than the gorilla and the chimpanzee from the spot which gave rise to human beings." Whether our present, acquired human gait was used also by these ancient anthropoids, walking as bipeds on South Africa's treeless plains during the Pleistocene, can not be decided until their lower limb bones are discovered.

A NEW method of inactivating plant disease viruses by both x-rays and ultra-violet radiation was reported on jointly by Drs. N. W. Pirie, of Cambridge University, and F. C. Wawden, of the Rothamsted Experiment Station. Their discovery points the way to a possible future method of vaccinating plants against diseases such as mosaic, curly-top and "frenching." It also indicates a way in which safer smallpox vaccine may be prepared. Irradiation enlarges the crystals that may be obtained from the viruses, and reduces their infectivity. Research is now being planned on foot and mouth disease of cattle, now one of Europe's most serious agricultural problems.

RACIAL DIFFERENCES

SUMMING up the lessons of a lifetime as America's pioneer anthropologist or student of man, Professor Franz Boas, in a communication to *The Nation*, denounces racial prejudice abroad and in its "almost equally potent" form in the United States.

Making a stirring plea for freedom from the "shackles of dogma," Dr. Boas, Columbia University emeritus professor, asks that all men apply to all mankind the same treatment and ethical standards that they apply to members of their own particular group of people.

"It is my fundamental conviction," he says, borrowing from his field, anthropology, the term "in-group" which applies to a clan or tribe or group of related people, "that the fundamental ethical point of view is that of the in-group, which must be expanded to include all humanity."

One of his few public utterances since his retirement from active teaching two years ago, Professor Boas sets his opinions down under the title, "An Anthropologist's Credo," one of a series of articles on "living philosophies" which *The Nation* is publishing.

"The identification of an individual with a class be-

cause of his bodily appearance, language or manners has always seemed to me a survival of barbaric, or rather of primitive habits of mind." Professor Boas is the author of "The Mind of Primitive Man," one of the classic books in the science of anthropology.

Discussing claims of superiority made by groups such as the Nazis in Germany, he declares: "It is pertinent to ask whether any group has a rational basis for a claim to rights not accorded to others. The hysterical claims of the Aryan enthusiasts have never had any scientific background. The belief that a necessary relation exists between the racial position of an individual and his mental attitude has never been proved. . . . We may fairly say that if we were to select the best third of mankind, according to intellect and personality, every one of the large races would be represented in that group."

Primarily an explanation of how one of America's most famous scientists, who was German-born and German-educated, but is an American by choice, arrived at his present outlook, the article nevertheless contains stinging comments on a number of current topics. "The crudest form of racial consciousness is at present confined to Germany—although with respect to stronger divergences, such as those between Negroes or Asiatics and whites, it is almost equally potent in the United States and in England, mitigated by a hypocritical desire to avoid legal recognition of the facts."

Freedom from the "shackles of dogma" is essential to proper scientific understanding and accomplishments, he indicates repeatedly.

QUESTIONS IN CHILD HEALTH CARE AND EDUCATION

SUGGESTING that cooperation by all concerned represents the best solution, Dr. J. B. Edmonson, of the University of Michigan, reports that health education and medical care for children in the public schools have raised problems to perplex officials.

One of these is possible conflict with the teachings of certain religious groups. Seven such issues are discussed by Dr. Edmonson in the current issue of *School and Society*.

1. How complete a program of health education and care should a school provide for all children? Here is a major question magnified by the present tendency to transfer responsibility from home to school.

2. Should the health objective or the recreational objective be the controlling aim in the school's program of physical education? Important particularly in the training of teachers for physical education is this matter.

3. What are the health facts having scientific endorsement that should be presented to pupils and what health habits should pupils be helped to form or strengthen? Material for such teaching should be free from the influence of propaganda groups. Dr. Edmonson indicated that at present health instruction is subject to suspicion by teachers, parents and medical men.

4. How much knowledge of health matters should a classroom teacher be required to possess? It is the classroom teacher who must watch for defects and see that they receive attention.

5. To what extent must the schools avoid health instruction that conflicts with the teachings of religious groups? Dr. Edmonson urges patience, tolerance, generosity and good will in handling this question.

6. Should school officials or other governmental officials be given the legal authority to require pupils to secure needed dental or medical attention when the parents neglect or refuse to provide the necessary care?

7. How can the most effective coordination of the community's health services for school children be brought about?

Dr. Edmonson points out that "The best type of program is certain to be the product of the cooperative efforts of those who are concerned with the promotion of a high level of individual and community health."

ITEMS

DELIVERING the official sermon before the gathering of the British Association for the Advancement of Science, the fourth ranking dignitary of the Church of England warned members that the world is now experiencing the worst period of suppression of scientific knowledge and truth in several hundred years. Scientists should participate in the social application of their discoveries, the Right Reverend C. F. Garbett, Bishop of Winchester, declared in urging upon them the necessity for defending freedom and tolerance, two of the cornerstones upon which scientific advance is based.

SCIENTISTS attending the British Association meetings saw a successful demonstration of an automobile without a clutch. Designed by Professor F. C. Lea, engineer of Sheffield University, the car uses a mechanism called a torque converter to transmit power from engine to wheels. The engine operates a centrifugal oil pump, speed of which is controlled by the accelerator which varies the amount of oil delivered to a turbine attached to the drive shaft. Should the car prove commercially feasible its introduction would mark one of the greatest changes in the automobile in the last ten years.

AIMING to make the first complete day and night records of Old Faithful's performance, Yellowstone National Park employees are installing air temperature, air pressure and interval-recording devices on the cone of the world's most famous geyser, Park Naturalist C. Max Bauer announced. The weather instruments will keep graphs of temperature and air pressure so that naturalists may determine the effects of these factors on eruptions, which now take place approximately every 66.5 minutes. The interval-recording device will work both day and night.

TASS reports that bacteria in the trunk, mouth, digestive tract and other parts of the frozen mammoth carcass recently found on Wrangel Island in the Arctic will be studied by Professor Karapetev, of the Soviet Academy of Sciences, as soon as it has been brought to Vladivostok. Professor Karapetev believes that he can revive the microorganisms and also parasites frozen upon the exterior of the body, as he has revived lower plant and animal forms found in the permanently frozen soil of Siberia.

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This guide may be used in supervised student teaching in either the elementary or secondary school. Also it may be used as a basis for one or more semesters of student teaching. By EDGAR M. COOK, Dean of Men, Associate Professor of Psychology and Education; and JOHN H. CATES, Principal of Jefferson City Elementary School, Director of Practice Teaching, Carson-Newman College. 137 pages, 40 Observation Sheets. Price, \$1.50.

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All phases of hygiene are covered in Turner's book. Not only are the usual points of hygiene of nutrition, digestion, excretion, etc., taken up in Part I, but all the newer trends in personal hygiene are also explained. Part II embraces the community aspect of hygiene. By CLAIR E. TURNER, Professor of Biology and Public Health, Massachusetts Institute of Technology. 4th Ed. 680 pages. Price, \$3.00.

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SCIENCE NEWS

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THE AMERICAN PATENT SYSTEM

Two thousand American chemists gathered at Milwaukee on Labor Day for their fall convention, at which the progress of a summer of research in the laboratories of the nation was described. Most important from the standpoint of every-day folks was perhaps the special session on the American Patent System, on September 6.

Mention patents and most people think of either eccentric inventors or patent lawyers. But, with a bit of thought, it will be realized that whole sections of American industry are built up on the seventeen-year period of monopoly which a patent grants to an inventor as the time in which he may exploit his discovery as best he can. Basic idea behind this monopoly grant is that it is a reward for disclosing, publicly, the facts of the invention which otherwise might be kept secret and, hence, lost to the public.

If applied to a better mousetrap this basic idea is relatively simple. The inventor can manufacture the article himself if no one else will. But, in the case of elaborate inventions and particularly in the case of chemical inventions, the process is frequently not so simple. A discovery in a test tube, or in a laboratory, is in many cases a long way from large-scale commercial production. First a small-scale plant must be created. This "pilot" plant, as it is called, serves to iron out the countless kinks which often appear under the less rigidly controlled conditions of commercial operations. And finally launching of the large-scale commercial plant must be undertaken. Then, and only then, are many discoveries given to the public after years of effort and many hundreds of thousands of dollars' investment in research and plants.

Among the proposals for improvement in the present patent system are plans for a quicker granting of patents, less costly patent litigation, fewer infringement lawsuits and some solution to the "frozen" invention problems. Frozen inventions are those covered by patents taken out solely for future legal protection without any present idea of putting the discovery in use in the immediate future. It was against this practice that the proposal for the licensing of an invention after three years was aimed in the legislation still under consideration.

Proposals regarding changes in the patent system touch the life of every one in the nation. Probably the leading news during the convention of the chemists will concern Hitler's hijacking maneuvers in Europe, Japan's jockeying in China and the scramble of the forces in Spain. But none of these touch the basic life of America as do discussions of the American patent system.—ROBERT D. POTTER.

THE CONVERSION OF COAL INTO PETROLEUM

THE Pittsburgh plant of the U. S. Bureau of Mines for converting coal into petroleum is now able to obtain from 70 to 75 per cent. yields of oil convertible to gasoline, according to a report made to the American Chem-

ical Society, by an eight-man research team of government scientists.

Thus, potentially, the Pittsburgh area of the coal mining region could produce some 12,000,000,000 tons of oil that could be made into gasoline if the time ever comes when it is needed. This estimate is based on the best and latest calculation of the amount of recoverable coal in the Pittsburgh coal bed, which is placed at about 16,020,000,000 net tons.

In a small, experimental plant at Pittsburgh, having a capacity of 100 pounds of coal a day, chemists of the U. S. Bureau of Mines are taking coal in the powder form, mixing it with heavy oil, squeezing it to pressures of over 3,000 pounds to the square inch and heating it to 824 degrees Fahrenheit. Under the heat and pressure, extra hydrogen atoms are added to the coal molecules. Out of the treatment comes an oil suitable for conversion into gasoline. This hydrogenation process, as it is known, was invented in 1915 by Dr. Friedrich Bergius, Nobel Prize-winning German chemist. It is said to have taken 13 years, working with 150 men and at a cost of about \$6,000,000, to turn the initial laboratory discovery into a commercial process which would work on a large scale.

Turning coal into oil is, for America, a process not now needed because of the plentiful supplies of petroleum available on this continent. But in Germany and in England—lacking oil within their boundaries—the process is widely used. Dr. H. H. Storch, of the Bureau of Mines, in presenting the report, said that in Germany five huge plants are making 900,000 tons of gasoline a year by coal hydrogenation. In England a single plant is turning out 150,000 tons of gasoline yearly in the same way.

At Pittsburgh the Bureau of Mines is clearly looking to America's future when the natural reserves of petroleum will have dwindled and science must turn to the much larger reserves of coal to produce oil and gasoline. By studying now the properties of American coal and its best hydrogenation treatment, preparations are being made for this distant day.

The report on the percentage yields of coal from Pittsburgh seam coal was prepared by Dr. L. L. Hirst, C. O. Hawk, R. L. Boyer, P. L. Golden, I. I. Pinkel, J. R. Schaeffer, R. H. Kallenberger, in addition to Dr. H. H. Storch.

The work at the Pittsburgh hydrogenation plant is directed by Drs. Hirst and Storch, under the general supervision of Dr. A. C. Fieldner, chief of the technologic branch of the U. S. Bureau of Mines, in Washington.

SUBSTITUTE MOTOR FUELS IN EUROPE

FEAR of war is a basic reason behind the amazing growth of synthetic and substitute fuels for motor vehicles in Europe, according to a report made by Dr. Gustav Egloff, of Chicago, to the American Chemical Society.

Fuels, not justifiable economically, are being ingeniously

applied to motor transport, behind the protection of direct monetary subsidy and excessive customs taxes placed on imported gasoline. For example, the tax per gallon on imported gasoline is 51 cents in Italy and 36 cents in Germany.

Behind this protection have developed amazing technical achievements which otherwise could not be placed in use on a commercial scale. In Europe, about a quarter of all motor vehicle transportation is accomplished with fuels of a substitute or synthetic variety at the price of hundreds of millions of dollars to consumers and governments above that which American gasoline would cost.

Gasoline made from coal and fuel gases from carbon monoxide are being widely used. Gas, generated from coal and wood on auto trucks, is used to run their engines. Alcohol made from vegetables is blended with straight gasoline in other cases. Scientists are even experimenting with motor cars which will operate on ammonia and acetylene. These substitute fuels seek to conserve the petroleum supplies against the day when war may come and gasoline supplies may be cut off.

Moreover, in the case of alcohol blend fuels there is an important but little-mentioned motive in keeping alcohol plants working to full capacity in peacetime so that when war comes large amounts of this basic material will be available for use in making munitions. During 1937 the countries of Europe suffered monetary losses of over \$100,000,000 by their subsidies on alcohol blended fuel alone. Behind such protection the European use of alcohol blended gasoline rose rapidly from 59,000 metric tons in 1930 to 646,000 metric tons in 1936.

But in 1937, when war scares were gaining prominence, the use of the alcohol-gasoline blend declined to 510,000 metric tons. This loss, according to Dr. Egloff, can not be attributed to beet crop failure in France and Italy, but rather to the diversion of alcohol to other uses which probably are connected with increased activity in the munitions industries.

Germany, Dr. Egloff states, is the principal user of compressed gases as fuel with some 25,000 vehicles using bottled gas in their engines. Depending on whether city gas, methane or propane-butane is used, the vehicles have to "regas" every 25, 85 and 225 miles, respectively. The cost of these three gases, compared on a gallon of gasoline basis, comes out to be 43, 41 and 61 cents, respectively. Gasoline, in Germany, sells for about 60 cents a gallon.

In France there are some 4,500 wood-burning vehicles, while Germany has 2,200 and Italy about the same. These machines burn wood, take the combustion gases and burn them in their motors. Wood is sold in packages of from 30 to 60 pounds, at many stations in Europe, for such vehicles. It is estimated that it takes 25 pounds of wood to yield the same number of miles of travel as can be secured on a gallon of gasoline. The cost is 16 cents. This is cheap contrasted with 60 cents a gallon for gasoline.

THE USE OF HIGH-SPEED MOTION PICTURE PHOTOGRAPHS IN THE STUDY OF CHEMISTRY

HIGH-SPEED motion picture photography is revealing

new and little-understood facts about chemical happenings, it was reported at the opening sessions of the American Chemical Society. The chemists opened their convention by going to the movies, but the movies showed something never seen before. And the "stars" of the show were tiny air bubbles rising through water.

As shown in the motion pictures, taken by Dr. Gustavus J. Esselen, consulting chemist of Boston, the bubbles were not spherical as is ordinarily thought. When their formation and upward movement were shown at a speed of 1,200 pictures a second, and their action slowed down 80 times, it was found that, often, each air bubble contained tiny drops of water inside. These drops were in constant motion and bounced back and forth across the bubble and off its walls as if the latter were of rubber. The bouncing of the water drops inside an air bubble could be seen to create little waves in the bubble's surface.

The bubbling of gases through a liquid is a commonplace phenomenon, but one which is of vital importance in the flotation of ores, the formation of soap lather in washing, the formation of gaseous emulsions and many other places in industrial processes.

While the use of motion pictures to study the happenings in such processes is still so new that immediate changes in procedure are yet unrealized, it is believed that the use of high-speed photographs may bring changes.

SULFANILAMIDE AS A PREVENTIVE OF GONORRHEA

A HINT that sulfanilamide, a chemical remedy which has already proved successful in treating many cases of gonorrhea, may some day play a part as a preventive of the disease appeared in the report of Drs. Grant Morrow and George Packer Berry, of the University of Rochester School of Medicine and Dentistry, to the Society of American Bacteriologists meeting in San Francisco. The use of sulfanilamide for prevention of gonorrhea was only hinted at and the Rochester scientists said nothing of such practical application of their research. They succeeded, however, in growing gonorrhea germs on the chorio-allantoic membrane of the chick embryo. This is an achievement in itself. The study of gonorrhea and search for a cure have been hampered heretofore by lack of any animal other than the human which is susceptible to the infection. With the germs of the ailment growing on the living tissues of chick embryos, various remedies and possible preventives can now be tested. Drs. Morrow and Berry reported that when a bit of the drug was dropped on the embryo 24 hours before inoculation of the gonorrhea germs, no infection occurred. In other words, the drug prevented infection with gonorrhea germs. The drug "cured" the condition, eradicating the germs, in other embryos inoculated before the drug was given.

Physicians have already found sulfanilamide useful in treating gonorrhea, and many spectacular cures have been reported. The reason for its success as a remedy now appears to be its ability to act somewhat as an antitoxin, inactivating the so-called toxin of gonorrhea germs. This inactivation of gonococcal toxin was reported by Drs. C. M. Carpenter, G. M. Barbour and P. L. Hawley, of the

University of Rochester School of Medicine and Dentistry. "Toxin" prepared from gonorrhea germs isolated from the knee joint of a patient suffering with gonococcal arthritis was injected into 116 mice. All these mice died. Then some of the "toxin" was mixed with sulfanilamide. Of 295 mice given this mixture, only one fourth died. The others apparently were protected by the antitoxic action of the sulfanilamide.

SYNTHETIC "VACCINES"

A REVOLUTION in disease prevention methods, which may make unnecessary in future the use of horses or other animals for vaccine preparation, appeared in reports to the Society of American Bacteriologists at San Francisco.

Instead of shooting germs into horses, and using their blood for a source of disease-fighting substances for human protection, scientists of the future may be able to confer this protection by chemical means. One step in this direction is the preparation, apparently for the first time, of a synthetic "vaccine" which protects rabbits against pneumonia. This was reported by Dr. Walter F. Goebel, of the Hospital of the Rockefeller Institute for Medical Research. No human trials were reported, but these presumably will be made after further animal studies.

A similarly synthetic "vaccine," this time against streptococci, which are the germ causes of scarlet fever, childbed fever and other dangerous ailments, was reported by Professor Stuart Mudd, of the University of Pennsylvania. This new type of vaccine was prepared by Drs. M. G. Sevag and D. B. Lackman, of the University of Pennsylvania.

These synthetic "vaccines," which technically should be called antigens, are chemicals. Ordinarily the germs produce such chemicals, and the body fights them off by producing other substances called antibodies. Dr. Goebel succeeded in preparing chemicals without benefit of the germs which call up the pneumonia antibodies just as the germ chemicals do. Drs. Sevag and Lackman obtained the chemicals from the streptococci or germs themselves. Such chemicals have been obtained from streptococci before, but never before in a state in which the chemicals had any practical, disease-protecting possibilities.

Another new pneumonia vaccine was reported by Drs. René J. Dubos, also from the Hospital of the Rockefeller Institute. This was prepared from pneumonia germs that had lost their disease-producing ability. Small amounts of this vaccine protect mice against one type of pneumonia only, but larger amounts give protection against others of the 32 types of pneumonia. No human trials were reported.

ITEMS

ANCIENT Americans who lived in Oregon caves and were harrassed by volcanic eruptions long ago have been discovered by a joint expedition of the University of Oregon and the Carnegie Institution of Washington. Some of these cave dwellers who suffered from an American Pompeii lived more than 10,000 years ago, which lends new evidence to the argument over antiquity of mankind in the New World. When these caves first were homes,

this continent was recovering from the retreat of the last great ice sheet. Some believe the first inhabitants of America may have come during the Glacial Period; others hold out for a much later discovery of America by Asiatic Columbuses. Layers of pumice above man-made articles tell the story of ancient cave life interrupted by the volcano. Professor L. S. Cressman, of the University of Oregon, who led the expedition, states that in one cave near Fort Rock an eruption evidently caused hot pumice to fall from the air, setting fire to straw and inflammable objects in the cave. In this cave, he found over 75 sandals made of shredded sage-brush bark, all charred. The disaster occurred between one and three thousand years ago.

AN Ice Age in the Twentieth Century: that is what the Alaska glacier field just discovered by the Harvard University-National Geographic Society Expedition turns out to be. It is the largest non-polar cap on earth—a latter day piece of the Pleistocene. It stretches over a distance of 235 miles, or as far as from Washington to New York. It has never been seen before because it is cupped in a vast nest of mountains which include some of the loftiest and most difficult peaks in North America. Only the coming of age of the airplane as an instrument of exploration has made its discovery possible.

THE Northern Lights do not cause the rustling or swishing sounds frequently attributed to them, according to Dr. A. S. Eve, of McGill University, in a new publication of the Smithsonian Institution. It is physically impossible for them to make sound, he explains, because the 60-mile-high atmosphere where they surge and flare is so rare as to be a fairly high vacuum, and sounds can not exist or travel in a vacuum. The noises heard and reported by many aurora observers, Dr. Eve suggests, are more probably due to electrical disturbances such as brush discharges occurring on the earth's surface near the observers, who fail to notice them because the Northern Lights are absorbing all their attention.

OUT of great tubes of glass, longer than the width of five city lots, quantities of heavy nitrogen isotope which are sufficient to supply many of the nation's laboratories with this hitherto rare gas, are being produced at Columbia University, under the direction of Professor Harold C. Urey their discoverer. Dr. Harry G. Thode has designed the new "factory" for the heavy nitrogen isotope. The device consists of 170 feet of glass column housed in three sections in the chemistry laboratory. Starting the gas containing heavy nitrogen only to the concentration of four tenths of one per cent., about two grams of heavy nitrogen having a concentration of over 70 per cent. can be produced in 24 hours. This recovery is equivalent to about three quarts of heavy water a day. Physicists and chemists in many laboratories now will be able to extend greatly their research on the structure of atoms and molecules. The same equipment can be used to concentrate the heavy sulphur isotope of mass 34 and the heavy carbon isotope of mass 13.

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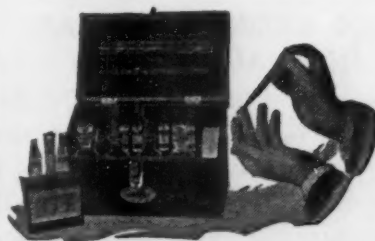
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SCIENCE NEWS

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HEAVY OXYGEN ATOMS USED AS TRACERS IN REACTIONS

ON a shelf in the chemistry department of Columbia University sits a small bottle, in whose contents lies much of the hope of science to produce, some day, many of the indispensable organic chemicals of the human body—like the vitamins and the hormones—which have profound effects on life. Columbia's little bottle contains no "Elixir of Life." But it does contain a special kind of heavy oxygen which is now being used as a tracer, to follow through complex organic chemical reactions. Now applied in the study of simple reactions and providing chemists with exact knowledge of how organic chemical molecules are made up, the heavy isotopic form of oxygen should, in the future, be applied to more complex molecules and aid chemistry eventually to create synthetic sources of vitamins, hormones and other growth-determining compounds.

Professor Harold C. Urey, 1934 Nobel laureate in chemistry, reported the increasing use of heavy oxygen atoms as tags or tracers in a variety of organic chemical reactions never before completely understood by chemists. In his report to the meeting of the American Chemical Society at Milwaukee, Dr. Urey, with Dr. Irving Roberts, pointed out that prior to the recent use of heavy oxygen as a means of tracing reactions, there were only about a half-dozen organic reactions completely understood, out of the hundreds which chemists can produce.

To this small stock of exact knowledge, scientists have now added five compounds whose reactions are understood. Thus in one spurt, in research that has been conducted at Columbia University, the University of Chicago and Manchester University in England, chemistry has almost doubled its stock of exact knowledge of how various atoms in simple molecules are put together.

But this, gratifying as it is, is only a beginning. When Columbia's 200 cubic centimeters of heavy oxygen has been increased, other workers can be supplied with the oxygen tracer atoms, and scores of investigators can start on other trails leading to more knowledge.

THE SYNTHESIS OF PORPHYRINS

A NEW research step on the road that may eventually lead to a synthesis of chlorophyll—the light-sensitive chemical which enables plants to convert light energy, water and soil foods into their body structure—was announced at the meeting of the American Chemical Society. Dr. Paul Rothmund, of Antioch College, and Amel Menotti, of the Ohio State University, described new advances in the creation, in the laboratory, of chemicals known as porphyrins, which are exceedingly light-sensitive. Such porphyrins can be obtained by the chemical degradation of nature's two most important color pigments—the green of plants and the red of blood—or they may be made synthetically, as in the researches of Professor Rothmund and Mr. Menotti.

If the naturally derived porphyrins are injected into

the blood system of experimental animals they become extremely sensitive to light and can live normally only in darkness or dim light. The new findings, now reported, describe the preparation of derivatives on the synthetic porphyrins which have a much greater effect than the natural porphyrins in making animals light-sensitive. "It is hoped that the energetic evaluation of the experiments will contribute to a better understanding of the process of photosynthesis and assimilation of carbon, the most important chemical reaction on earth."

The experiments, in which the porphyrins were injected into animals, have interest because parallels exist in nature of this photosensitive effect. Animals eating large amounts of buckwheat become sensitive to light. Western sheep grazing on certain plants in Nevada, Utah and Idaho succumb to an acute illness, known as "big head," whose symptoms include porphyrin photosensitization.—ROBERT D. POTTER.

DISCOVERY OF A GIANT DOUBLE STAR

A TREMENDOUS double star whose two components periodically eclipse each other was added to the catalogue of the wonders of the heavens by Dr. Sergei Gaposchkin, of the Harvard Observatory, in a report to the American Astronomical Society meeting in Ann Arbor.

The star, located in the constellation Scorpio, has, of course, been known before, and while astronomers suspected its great size, it had not been proved; nor was it known to be a double star until Dr. Gaposchkin detected this fact through intensive spectrographic studies.

The star is very hot, with a temperature somewhere between 15,000 and 20,000 degrees Centigrade. It has an average brightness magnitude of about 6.5. This varies by about a half a magnitude as the two parts rotate about each other during its 12-day period. Dr. Gaposchkin has made no estimate of its size beyond the fact that it is massive and is probably among the largest stars of its type yet found. Investigation, which is still in progress, has centered about the study of more than 150 photographs of the star, going back as far as 1910. It has also been studied by Mount Wilson observers, who were among the first to suspect its size and importance.

Dr. Gaposchkin's wife, Dr. Cecelia Payne Gaposchkin, reported to the conference on the progress of an intensive study she has been conducting of bright variable stars. The investigation, covering stars as faint as the 10th magnitude, during the past half century, is expected to be very important for statistical purposes.

A NEW METHOD FOR TRACKING METEORS

VIBRATION of the motor that drives the shutter on a camera used for photographing meteors traveling through the atmosphere has led accidentally to a new method for tracing the paths of the night-time visitors, as reported to the American Astronomical Society. The method, expected to constitute a valuable check on current means of investigation, was discovered accidentally by Dr. Fred

L. Whipple, of the Harvard Observatory, during routine sky patrols. The studies were being made by the usual method of photographing the sky through a motor-driven shutter which breaks the trail of a meteor 20 times a second, to reveal clues to its angular velocity.

On one meteor trail, that of an object about 60 miles away, the photographic plate revealed a wiggle, or side-sway, of about 20 feet. This raised the question as to whether a meteor moves in a straight line or swings from side to side, and Dr. Whipple measured other trails snapped with this apparatus to answer it. He found that practically all the trails had wiggles, but not in the same pattern. Then, examining the trails of meteors snapped without the motor-driven apparatus, he found there were no wiggles at all.

The solution, he discovered, was that the motor which drives the shutters shakes the entire camera mounting. The fact that this vibration is at the rate of about 16 times a second makes it act like the shutters, and thus affords an independent means of studying the phenomena. Dr. Whipple estimates that the accuracy of the new method is to within 5 to 10 per cent. Thus it is not as precise as the shutter method, but it is far better than any other.

"SLEEPING SICKNESS" IN THE MIDDLE WEST

FARMERS in middle western states are anxiously waiting for the first fall frost in the hope that, by killing mosquitoes and flies, it will check further spread of the "sleeping sickness" epidemic which has been taking heavy toll of horses.

While existing to some degree in thirty states, the disease, technically termed "equine encephalomyelitis," has been especially prevalent in Minnesota, Wisconsin and Iowa the past summer. Lately it has been working eastward; it has appeared in northern Illinois and a few cases were recently reported in Indiana.

As described by Wayne Dinsmore, secretary of the Horse and Mule Association of Chicago, symptoms of equine sleeping sickness include "dullness, sluggishness, drowsiness and a tendency of the eyes to close." The animal is unable to control leg movements, he said. Front feet may cross each other or hind feet may not travel in the direction the animal is moving. The horse will blunder over familiar obstacles as though blind or may drag the toes of one or more feet. It often acts as though it were about to sit down, carrying most of its weight on hind legs. Some subsequently go blind or become "dummies" and are of little use thereafter.

Mr. Dinsmore stated that "the disease is seasonal; it is known to be carried by at least five species of mosquitoes and also, probably, by biting flies, but by no other means, so far as known. No one knows the origin of the trouble. It does not exist in foreign lands, but Rockefeller Institute investigators have suggested that it may possibly be brought in by birds migrating from the tropics up along the air trails over the Atlantic coast and the Mississippi River. These birds are bitten by mosquitoes which may pick up the sleeping sickness or-

ganism in the birds' blood and then transmit it to the horses. There is no cause for panic, however. Although serious, the epidemic is overrated in popular estimation. The horse and mule population of America is around 16,000,000, so the 33,000 animals lost last year are only a small proportion of the whole. With the approach of cold weather the mosquitoes will lay off and the situation will get back to normal."

FOSSIL ANTHROPOID SKULL FOUND IN SOUTH AFRICA

THE story of how four of "the most valuable teeth in the world" were carried about in a schoolboy's trouser pocket is told by Dr. Robert Broom, of the Transvaal Museum, Pretoria, South Africa, in *Nature*, in describing the discovery of remains of a previously unknown form of fossil anthropoid ape. In certain features this fossil ape is closer to man than any anthropoid ape, whether extinct or still in existence, known from any part of the world.

The discovery was made by a schoolboy, Gert Terblanche, who knocked part of a fossil skull and jaw out of an outcrop of fossil-bearing limestone deposit near the top of a hill at Kromdraai, about two miles from the Sterkfontein cave where Dr. Robert Broom made his previous discovery of a fossil anthropoid skull. The boy gave away part of the palate with one molar tooth still attached. This came into the possession of Dr. Broom, who, recognizing that it belonged to a new type of anthropoid, found the boy, with four teeth still in his possession, and with his help extracted further fragments of the skull from the deposits.

Dr. Broom now has the nearly perfect palate with most of the teeth, practically the whole of the left side of the lower part of the skull and the greater part of the right side of the lower jaw. Nearly the complete dentition is now known, as it has been possible to reconstruct missing teeth from the impressions in the matrix.

The remains are those of a large ape, larger than the male chimpanzee and nearly as large as the female gorilla; but the parts of the skull which have been found show that it resembled neither chimpanzee nor gorilla. These include part of the cheek bone, and show how the jaw was articulated to the skull. Except that they are much larger, their form and relation one to another differ from that found in the ape and are almost exactly as in man.

No fossil ape has ever been found which is so nearly in line with man. The disposition of the teeth and arch of the jaw is more like that of man than of the anthropoids; while the canine teeth, which are large in the apes, are relatively small and very human in shape. In several other details the teeth bear a remarkable resemblance to the human.

Further, from the relation of the bones of the skull one to another as compared with that found in the chimpanzee and the gorilla, Dr. Broom is able to deduce that this anthropoid walked somewhat more erectly than the living anthropoids.

From the fossilized remains of the animals found in the deposit, Dr. Broom concludes that this anthropoid, to

which he proposes to give the name *Paranthropus robustus*, to suggest its close relation to man, belongs to the period of the Middle Pleistocene, whereas the Taungs skull, *Australopithecus africanus*, discovered by Professor Raymond Dart in 1925, belongs to the earlier period of the Lower Pleistocene, and the Sterkfontein skull, discovered by Dr. Broom himself, belongs to the Upper Pleistocene.

Some further teeth and a part of the front of a young male jaw belonging to the Sterkfontein type of anthropoid have also been found recently by Dr. Broom. On this new evidence he concludes that the Sterkfontein skull is even closer in its resemblance to man than he had previously thought. He therefore proposes to alter its name accordingly to *Plesianthropus transvaalensis*.

From these three important discoveries—the Taungs skull found in 1925 by Professor Dart, the Sterkfontein skull, of which the first fragments were found by Dr. Broom in 1936, and the Kromdraai skull, of which the discovery in 1938 is now announced—it is evident that there survived in South Africa so late as Pleistocene times a number of large-brained anthropoid apes which in certain details of their structure and especially in their teeth came close to man—all of them, in fact, resembling man more closely than do either chimpanzee or gorilla.

As Sir Arthur Keith has pointed out, they are too late in time to come into the direct line of succession which leads up to man; but they indicate the lines upon which the earlier forms of anthropoid apes, from which they themselves were descended, must have been modified in the growth of the human tree.—E. N. FALLAIZE.

ITEMS

FERNS and trees of a "Lost Eden" in South America, studied by Professor Edward W. Berry, of the Johns Hopkins University, have yielded a list of 92 species hitherto unknown to science, according to a report made to the Geological Society of America. The plant remains were found buried in volcanic ash in the province of Patagonia, Argentina, where they were overwhelmed by tremendous eruptions dated by Professor Berry as during Miocene times, between 20 and 25 million years ago. Whole plants, twigs and scores of leaf specimens were carefully dug out and examined by Professor Berry. Large fern plants, closely related to the ferns of North America, were unearthed, and also twigs and leaves of the ginkgo. Coniferous trees are also represented. In general, the new-found fossil flora is strikingly American. Fourteen of the genera are known only from South America, while 26 are confined to the Western Hemisphere and are nearly all equatorial America.

THE first case of tick paralysis reported in the eastern United States, so far as is known, is described by Dr. J. Heyward Gibbes, of Columbia, S. C., in the current issue of the *Journal of the American Medical Association*. Tick paralysis is not to be confused with Rocky Mountain spotted fever, although both ailments may end fatally, both follow tick bites and both were first found in a small area in the Northwest. Tick paralysis is an ascending type of paralysis, attacking the lower part of the body

first and moving upward. It sometimes results in death from involvement of nervous tissue at the base of the brain. Reports of cases from Washington, Wyoming, Montana and British Columbia have previously shown that the condition promptly disappears when the feeding tick is found and removed.

A NEW device which, by determining the direction from which an approaching airplane's radio transmitter is sending signals, enables airplane dispatchers to know the direction of approach of incoming planes even though weather conditions may make the planes invisible has been developed at the Bell Telephone Laboratories. Intended as an additional safeguard for private and commercial radio-equipped aircraft, the device locates a tiny green light speck on a frosted glass screen in accordance with the direction from which the plane is coming. The points of the compass are marked around the screen's edge. The system provides for indication on any 10 wave-lengths which may be selected remotely. As each pilot talks to the control tower at his destination, the spot of light waves moves instantly to its correct position on the screen of a cathode ray tube. A pick-up antenna of special design is employed; this may be situated at any remote point. A single telephone line connects antenna and dispatcher.

ACCORDING to *Chemical and Metallurgical Engineering*, a new building material said to have remarkable insulating qualities has been prepared from pickling liquor, the acid-containing waste material produced at the rate of 2,000 tons a day by the nation's steel mills. The process for its manufacture, invented by H. Seymour Colton, of Cleveland, is stated to be simple and the amount of capital required is small. Its importance lies in the fact that disposition of the pickling liquor, which results from treatment of steel with sulphuric acid, has been a difficult problem. A cause of stream pollution, its disposal into creeks and rivers is prohibited in several states and will be prohibited by a proposed federal law against stream pollution. It kills fish life and has also a corrosive effect on any metal in the stream. Called "ferron," the new material is largely a coprecipitated iron oxide and calcium sulphate. At one stage in its manufacture it is plastic and can be molded into any desired shape. Resembling wood in many respects, it is said to be fire-proof, termite-proof and water-proof.

A NEW voluntary standard for marking gold jewelry that provides that every quality mark shall be accompanied by a registered trade mark to fix responsibility has been issued by the National Bureau of Standards in cooperation with jewelry trade associations. Formulated at public hearings at which the tolerances of the National Stamping Act of 1906 were scored as being too "liberal" and as allowing some manufacturers to take advantage of the marking allowances of the law to sell below-grade goods, the standard goes into effect on new production on November 25. Ten-karat gold is the minimum on which a quality mark should be permitted, it was decided at the hearings.

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SCIENCE NEWS

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HYDROGEN AND OXYGEN GASES FOUND
IN THE MILKY WAY

A GLOWING mass of hydrogen and oxygen gases, hitherto undiscovered, envelops large portions of the Milky Way, Drs. Otto Struve and C. T. Elvey, of the University of Chicago's Yerkes Observatory, reported to the American Astronomical Society meeting at Ann Arbor.

These luminous nebulosities, in the constellations of Cygnus and Cepheus, are too faint to be recorded on direct photographs. They were found with the new 150-foot nebular spectrograph of the McDonald Observatory of the University of Texas in the Davis Mountains. Their existence could only be proved by means of spectrograms photographically sensitive to the light of the parts of the spectrum known as the hydrogen line alpha and the forbidden oxygen line 3727.

To an astronomer who could observe our vast Milky Way galaxy from some object far outside it, the spectrum of our galaxy as a whole would have an appearance different from what astronomers supposed it would before the discovery by Drs. Struve and Elvey. It would reveal "a fairly strong emission spectrum superimposed over the integrated spectrum of all the stars." The newly discovered great "clouds" do not shine by their own light, but they appear to derive the required energy of their fluorescence from the general field of stellar radiation in the Milky Way star clouds. They differ from brighter nebulosities in that they are not concentrated toward individual stars.

Drs. Struve and Elvey consider it probable that many other portions of the Milky Way are covered by similar gaseous "clouds," but an investigation of a region in Canis Major shows practically no trace of nebular emission. The emission decreases very rapidly away from the Milky Way and at galactic latitudes of 10 or 20 degrees no emission is found.

A new theory of a circular motion of stars "streaming" at high speeds in our galaxy was presented by Dr. S. Chandrasekhar, of the Yerkes Observatory. Dr. Chandrasekhar's theory visualizes our near-by stars, among them the sun, swinging nearly circular orbits about the center of the galaxy. If the near-by stars are taken as a group, the individual stars seem to be moving at random, with equal numbers of stars moving in opposite directions. But there is a maximum mean speed of the order of 15 kilometers per second (9 miles per second) in one direction. As a whole, however, this group has a nearly circular motion about the distant galactic center, a velocity of about 300 kilometers per second (185 miles per second). The theory explains the dispersion of velocities with respect to the center of the local star group as due to the deviations of the actual orbits from a true circular orbit.

MATHEMATICAL EQUATIONS FOR USE IN
FLIGHTS IN STRATOSPHERE

WITH pencil and paper John Sweer, expert of the U. S. Naval Research Laboratory, has completed computations

which will aid future stratosphere fliers traveling above 50,000-foot altitudes.

Mr. Sweer's calculations involve the bending experienced by a ray of light as it passes through the earth's atmosphere. This refraction, as it is called, must be determined and corrected for in all aerial navigation where "sights" are taken on the horizon and on a star to determine the latter's angular altitude.

Using a more general formula than previously employed, Mr. Sweer gives methods for computing the corrections for any altitude. In an interview he explained that actually 100,000 feet is about the limit at which aerial navigators will need to worry about the bending. Above 100,000 feet the atmosphere is so rarefied that further increase in altitude does not increase the amount of bending of the light rays.

The corrections which must be applied even at altitudes of 30,000 feet are quite large and amount, for this height, to 27 minutes of arc. Instrumental errors of a good sextant, by comparison, are only a half minute of arc. Mr. Sweer points out that the large corrections must be subtracted from the observations, for the star on which the sight is taken is really lower than it appears to be. The corrections overcome the fact that the earth appears to be flatter than it really is, when observed from great heights.

In 1919 a British scientist, A. R. McLeod, published corrections for altitudes of 50,000 feet. The new work of Mr. Sweer uses a more general formula and extends the correction range to 100,000 feet and above. His report appears in the *Journal of the Optical Society of America*, published recently.

A NEW FORM OF CRYSTAL

AN accidental discovery in a research laboratory at Pittsburgh has led to the discovery of a new crystalline state of boric oxide which promises to change certain commercial glass manufacturing methods.

Leon McCulloch, research engineer of the Westinghouse Electric and Manufacturing Company, recently fused some boric acid in a tin can in an oven, trying to keep the mixture liquid so that it could be used to impregnate electrical coils and insulate them. But the mixture turned white and milky and then pasty. Finally it turned stonelike and about as hard as Portland cement.

Such a mass was useless for insulation purposes, but Mr. McCulloch began to study its properties. On weighing, it was found to have a specific gravity one third greater than the comparable boric oxide glass. Moreover, its crystal structure was revealed by a definite melting point and by x-ray studies. In contrast, its relative boric oxide glass has no fixed melting point and does not exhibit a characteristic crystalline x-ray spectrum. What happened, it now appears, is that the tin can and the hot oven changed the boric acid to a crystalline state just as flavored sugar syrup changes to fudge on boiling.

Boric oxide glass plays an important chemical and industrial rôle because of its high resistance to heat shock.



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Designed for workers in both plant and animal tissue, the second edition of this book is an essential part of every laboratory's equipment and an ideal text for courses in the subject. Among the new material presented in the new expanded edition are directions for free hand manipulation of living material, methods for staining boutons terminaux, an account of the fused quartz method of illuminating living structure, a description of fluorescent microscopy and so on. The book has been written by thirty-four distinguished authorities and edited by C. E. McCLUNG, Professor of Zoology, University of Pennsylvania. Waterproof binding, illustrated, \$8.00

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The new discovery, it is claimed, should prove helpful in commercial glass manufacture, perhaps supplanting boric oxide glass in a number of processes.

The accidental discovery, made in an age when modern research is planned to the last detail, is reminiscent of Goodyear's classic discovery of vulcanization by the dropping of rubber and sulfur on a hot stove.

HEALTH INSURANCE

THE American Medical Association's house of delegates will oppose the National Health Conference's plan for adding health insurance to social security—if it follows action taken three years ago. In 1935 the doctors' parliament was called into extraordinary session and opposed the social security suggestions thereafter enacted into federal law.

On September 16 it convened to formulate authoritative medical opinion on the Federal Government committee's plan for nation-wide health promotion. Included in this plan is a recommendation of a sickness insurance scheme on a nation-wide basis to be supported either by general taxation or special tax assessments, specific insurance contributions from potential beneficiaries, or both. It is a new phase of social security.

In 1935 the American Medical Association reaffirmed "its opposition to all forms of compulsory sickness insurance whether administered by the Federal Government, the governments of the individual states or by any industry, community or similar body." At the 1935 meeting on social security, the association encouraged "local medical organizations to establish plans for the provision of adequate medical service for all of the people, adjusted to present economic conditions, by voluntary budgeting to meet the costs of illness."

It also recognized "the necessity under conditions of emergency for federal aid in meeting basic needs of the indigent." This suggests that the part of the new plan proposing federal aid to the medically indigent will not be opposed, unless the federal subsidies for medical services are administered or controlled by a lay bureau.

Provisions of the national health plan which would extend public health services and hospital services through federal aid will probably not be opposed. Action in pre-Social Security days does not throw much light on the stand of the association on these two points. But extension of public health and hospital service, so long as they do not enter into practice of medicine is likely to be welcomed by most physicians, except those who fear existing hospitals might suffer financially—JANE STAFFORD.

LACTIC ACID FORMATION

NEW light on how our muscles work is reported in a paper read before the Milwaukee meeting of the American Chemical Society by Drs. Eunice V. Flock, D. J. Ingle and J. L. Bollman, of the division of experimental medicine of the Mayo Foundation, Rochester, Minn.

Lactic acid formation in the muscles—which results from the breaking down of glycogen—acts as a "starter mechanism." The formation of lactic acid in muscles from the breakdown of glycogen, an energy-producing substance stored in muscles, when they start their ac-

tivity, has long been known. For many years it was thought that this chemical reaction gave rise to the energy of contraction. But in 1930 Lundsgaard showed that in muscles poisoned with iodo-acetic acid contractions take place although no lactic acid is produced. His theory was that the energy comes from the breaking down of phosphocreatine into creatine and phosphoric acid.

In the Mayo studies it is shown that the continued working of a muscle can occur without lactic acid accumulation, that the formation of lactic acid from glycogen occurs only at the beginning of exercise and appears to be rather a starter type of reaction. What happens in the working muscles to suspend the formation of lactic acid is not known, but it appears to be a local process in the contracting muscles since, in a test on dogs, it was shown that when one leg was working continuously without lactic acid accumulation the opposite, resting leg will produce a maximal amount of lactic acid under stimulus. After a continued period of work this leg, too, returns to a steady lactic acid content. The authors state that "the reactions involving the breakdown of glycogen and phosphocreatine are the early stages only in working muscles. With continuous work . . . it seems probable that the major energy is derived from substances brought to the exercising muscle by the blood."

SUPPRESSED PATENTS

THE American Chemical Society, through a notice to members under the signature of Dr. Charles L. Parsons, secretary, has asked its members to report to the society any cases of patents suppressed to prevent their further development and commercial exploitation. Referring to recurrent reports of such suppressions, Dr. Parsons points out that "this matter of the suppression of patents is one of great importance to the American people, and if the rumors are true, they should be informed thereof."

Suppression of patents has been repeatedly charged in connection with several recent proposals that the U. S. patent laws be revised to make such a practice impossible and to correct other abuses with which the present patent system is charged.

"Such information," Dr. Parsons states, "to be effective, must of course be accompanied by definite statement in sufficient detail for presentation to any congressional committee on patents before whom a representative of this organization may appear."

Such information as is gained, it is intimated, will be used when the society, in conjunction with a number of other technical groups, appears before the congressional committees on patents to consider basic changes in the law which are expected to be introduced at the next session of Congress.

Sponsored by Representative William D. McFarlane, one bill would limit to five years the absolute monopoly now granted for seventeen years. At the end of five years, if the patent holder has engaged in monopolistic practices or has refused to develop the patent to the stage of commercial application, compulsory licensing would occur. Determination of whether monopolistic practice or of suppression has been resorted to would be in the hands of a Patent Office agency.

TREASURE ISLAND, SAN FRANCISCO, AS A LAND AND SEA AIR BASE

PARALLELING the development of the North Beach Airport, New York, as a great combined land and sea air terminal, Treasure Island, the site of the Golden Gate International Exposition of 1939, will probably become a terminal for domestic landlines as well as for Pan-American Airways' transpacific division, following close of the World's Fair of the West, it was learned.

Airline operators look with favorable interest upon the proposal to develop the man-made fair site into an airport because it will mean a single stop in the San Francisco Bay area in place of the two now made on most flights. Domestic planes now stop both at Oakland, in the East Bay area, and at Mills Field, San Francisco. Cutting out one of the stops will mean 10 or 15 minutes less flying time. In addition, the island is within a very few minutes of downtown San Francisco via the Bay Bridge. Mills Field is three quarters of an hour from the Golden Gate city's hotel district.

The San Francisco Bay Bridge, which crosses the bay near one end of Treasure Island, is not a hazard in clear weather, in the operators' opinion, because of the fact that the prevailing wind parallels the bridge.

At times when instrument landings (which should be standard bad weather practice by the time the airport is ready) are required, the Oakland Airport will be used. This should be necessary at most 15 per cent. of the time.

Approval of such a move is, of course, up to the Civil Aeronautics Authority which, when the time comes, will have to pass upon the suitability of the port as a site. Unanimous support for the change is not expected, for sponsors of airports rarely welcome a change in location.

Pan-American Airways has already made arrangements to use Treasure Island in place of its Alameda base from the time the fair opens. The twice-a-week clipper departures to New Zealand and the Philippines, a schedule expected to be in operation by that time, will provide the most prominent part of the Pan-American Airways exhibit.—LEONARD H. ENGEL.

ITEMS

A SUBMERGED volcano, in water two miles deep off the coast of California about 150 miles southwest of Catalina, has been discovered by an expedition of the U. S. Coast and Geodetic Survey. Professor W. F. Shepard, of the University of Illinois, at present working at the University of California's Scripps Institution of Oceanography, determined the nature of the submarine mountain, which has two craters. Whether or not it is active has not yet been learned.

LIFE as it was lived millions of years ago on the San Francisco Fair site will be shown on a great diorama now being painted, which will be finished in time for the opening of the fair. What is now Treasure Island was then a great marsh, whose soggy soil trapped great lumbering long-jawed mastodons and swallowed up the saber-toothed tigers that leaped upon them when they were down and helpless. The painting will also show the primitive cam-

els and little horses of the era. Other dioramas of ancient life under preparation for the fair include scenes at the La Brea asphalt pits in Los Angeles, the San Joaquin Valley, the St. John's area in Arizona and the Craddock bone beds in Texas.

GIANT pandas from Asiatic mountains, now attracting much attention in zoological circles, are only returning to their ancestral homeland when they come to America, according to Paul McGrew, paleontologist at the Field Museum of Natural History. Both the giant and the smaller "ordinary" pandas descended from a long-extinct, rather small mammal known as *Cynaretoides*, that lived in North America about twelve million years ago, during early Pliocene times. Descendants of the same ancestral stock that stayed at home became the familiar raccoons of American woods.

WITH suitable equipment placed in regions of the earth where mountain-building is still going on, scientists may some day learn the secret of strange variations in the earth's speed of rotation. This is suggested in the annual report of the Smithsonian Institution, by the late Dr. Ernest W. Brown, professor of astronomy at Yale University. Checking movements of the sun against movements of the earth for the last 150 years, Professor Brown found that there is little reason to doubt that real changes in the earth's rate of rotation do occur. His calculations indicate changes about the year 1790, again in 1897 and also in 1917. The 1897 change altered the apparent length of the earth's year by one second. Professor Brown's own suggestion for the cause of such a change is that in the earth there is a layer, near the surface, which has the ability to undergo relatively great volume changes for small temperature changes. Thus a small change in the earth's internal condition might make a sizable volume change in the earth. A change of only five inches in the earth's radius could produce a one-second difference in the length of the earth's year. A test of this hypothesis, he adds, could be made by studying bulges in the earth and the most likely place to look for them would be in regions in which mountains are still rising.

THE world's longest direct telephone and telegraph line, to link Moscow with strategic Khabarovsk in far-off eastern Siberia is now being built by the People's Commissariat of Communications, Tass, Soviet telegraphic agency, reports. The new line will be 8,678 kilometers (about 5,100 miles), almost 1,300 miles longer than the Halifax-Vancouver line, hitherto the world's longest. The equipment to be used will enable simultaneous transmission of three telephone conversations, 19 telegrams and one facsimile reproduction over a single pair of wires. Whether the line is being built along a railroad or along which railroad, if it is, was not stated, but it is believed the line will follow for part of the way the new Balkai-Amur railway, being rushed to completion 800 miles north of the Trans-Siberian Railway. Both are among the most strategic railways in the world.



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SCIENCE NEWS

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THE EVOLUTION OF NOVAE

A NEW theory of evolution for "exploding" stars, called novae by astronomers, is suggested by Professor George Gamow, of George Washington University, in the current issue of *The Physical Review*.

Stars grow old, Professor Gamow's hypothesis suggests, by gradually burning up their hydrogen and getting hotter and brighter. A source of nuclear energy within the star causes this first stage. Next point in the star's evolution is a progressive contraction in which the star's radiation comes from gravitational energy only. However, at the turning point between hydrogen-burning and the gravitation contraction, the star's mass must redistribute itself. During this redistribution of mass, gravitational energy is liberated which shows up as a short-time additional brightness. It is this brightness, he adds, which may well be the cause of the bright flare-up of the so-called "new" stars.

What happens to the star, after contraction sets in, depends on its mass when the contraction starts. For small stars less than 3.2 times as large as the sun the contraction leads to the well-known type known as the white dwarfs, which have "a degenerated electron gas inside and very small energy production." For the larger stars, however, the contraction creates a central neutron core inside the star which represents "a practically unlimited source of energy." The growth of such a neutron core will bring about an increase in the amount of energy liberated and probably makes the star's atmosphere expand. In this state it may enter the star class known as the giants. Finally the explosion of such giant stars will lead to extremely bright novae which might be identified as the super-novae; a class suggested by Professor Fritz Zwicky, of the California Institute of Technology, and Dr. Walter Baade, of Mount Wilson Observatory.

Astronomers could check the new hypothesis, Professor Gamow suggests, by seeing if the spectrum of the star known as Nova Corona belongs to the M giant class of stars.

DAILY CHANGE IN THE PRESSURE OF THE AIR

THE U. S. Naval Research Laboratory reports a new, and a previously undetected, factor which may upset weather forecasting. Changes in barometric pressure—one of the basic effects used in forecasting storms and their centers of action—have now been found to occur with a daily cycle which fluctuates with the hours of the day as determined by star time.

Dr. H. B. Maris, in a report to *The Physical Review*, points out that the barometric pressure not only has tides due to the sun—as has long been known—but also shows stellar pressure tides. The greatest sidereal effect appears to come in high latitudes, in the northern hemisphere, in the vicinity of a line drawn through Sitka, Alaska. At this latitude the sidereal pressure change may be as great as .167 millimeters of atmospheric pres-

sure. This seems small, but it amounts to about one thirtieth of the entire barometric change that occurs in common storms. Since many of the storms which sweep over the United States arise in northern latitudes any errors, due to the new effect, which may occur in forecasting there have repercussions southward in this country.

Dr. Maris states that "The position of the troughs and crests of the pressure wave, as viewed from a fixed star, shows a drift to the east with change in latitude toward the south. This effective time lag suggests that the driving force is applied in the northern hemisphere."

RADIO WAVE-LENGTHS

ACCORDING to J. A. Pierce and H. R. Mimno, of the Cruft Laboratory, Harvard University, in *The Physical Review*, American radio amateurs in thirty states have enabled them to learn new facts about the strange behavior of the electrified "E" layer some 74 miles above the earth.

Transmission on the ultra-high frequency band of 56 to 60 megacycles—a band contemplated for television transmission—has been found to have amazingly long pickup; 2,500 miles in an extreme case. Over 700 contacts between amateurs on this band on the single night of last June 5 show receptions of these supposed line-of-sight frequencies over distances of 600 miles in many cases. And in exceptional cases reception was obtained over distances of over 1,400 miles.

Working with amateur contacts assembled by the American Radio Relay League, amateur radio's coordinating organization, data gathered from hundreds of "ham" operators were used to discover that two happenings on June 5 led to the amazing distance, or DX, reception.

They found that high over the eastern United States on this date there was a remarkable coincidence of great E layer ionization with unusual atmospheric bending of the transmission paths a mile or two above the earth. This giant bending area, roughly oval in shape, stretched in an east-west direction from Providence, R. I., to Akron, Ohio, and north-south from Rochester, N. Y., to Gettysburg, Pa. It was this condition which accounted, they believe, for reception up to 300 miles. The much greater DX reception, reaching up to 1,400 miles in one case, is explained by direct reflection off the E layer. This distance is the maximum which can be secured with a single reflection off this layer. Still later reports to Science Service show evidence of a double reflection off the E layer and a total transmission distance of 2,500 miles.

The 56 megacycle (56,000,000 cycles a second) band on which these observations were obtained has recently been opened to amateur transmission by the Federal Communications Commission. For many years it has been regarded as a strictly local band of communication for the signals appeared to travel pretty much in line-of-sight and were often blocked out by obstacles and by the horizon. Parts of this and neighboring bands have been

assigned for television transmission, and it has been one problem of television to get around the restricting local characteristics of signals on these frequencies.

DECLINE IN THE YIELD OF METALS FROM ORE

THE continued rise of the "ghost camp" mining towns, with their stranded populations and economic stagnation, is forecast in a study prepared by experts of the Works Progress Administration in connection with the U. S. Bureau of Mines.

In a monograph entitled "Mineral Technology and Output per Man Studies: Grade of Ore," Andrew V. Corry and Dr. O. E. Kiessling show that, for the non-ferrous metals, the grade of ore which can be economically worked at a profit has steadily and consistently declined through the years. The salvation of mining, they point out, is the increased advances made from the technological side.

Thus gold can now be worked, at a profit, when it appears only in one part per 850,000, by weight, of ore. Since 1910 the yield of gold and silver ores has declined from \$9.83 per ton of ore to only \$5.58 a ton, where the comparison is based on constant price levels and not on the price change due to the revaluation of the dollar. In copper mining nearly half the nation's present supply comes from mines which were considered worthless in 1900. In lead mining there is a 27 per cent. decline in ore yields since 1910. Metal mining has had to adjust itself to a much lower grade of ore, and technological ingenuity is the way the adjustment has been achieved.

But the effect of this change on the miner is profound. "It is not difficult," says the report, "to identify . . . social implications of the declining grade of ore. Those with long experience in mining frequently raise the question of why employment readjustment is more difficult to-day than twenty or thirty years ago when the typical miner moved quickly to greener fields. The answer is that in the earlier period mining was still in the era of great expansion, and increased work opportunities resulted from rising production of more stable camps and from the opening of new deposits; these developments more than offset the labor saved by technical progress. To illustrate how changing ore tenor affects the life of mining areas, one needs only to call the long roll of formerly great camps where pristine vigor has waned and problems of employment and social readjustment abound in the little communities left troublesomely stranded about them."

SYNTHETIC SILK

A NEW artificial silk, superior to natural silk or any synthetic rayon in its fineness, strength and elasticity, was patented by the late W. H. Carothers, chemist of the E. I. du Pont de Nemours Company.

For the past month du Pont officials have maintained a complete silence, in the face of many rumors, on the nature and properties of a new fiber which was superior to silk and potentially could run silk off its last existing market in the hosiery field.

Completely synthetic in their origin, the new fibers can

be easily drawn to a size only one tenth the diameter of a natural silk filament, or in the extreme case, to only one seventy-fifth the diameter. Yet the new fiber shows a tensile strength equal or better than that of silk. In some cases the fibers are 150 per cent. stronger than silk.

It is stated in the patent that "The elastic recovery of these fibers under moderate elongations was very remarkable, and in this respect was much superior to existing artificial silks." The fibers are "lustrous and silky in appearance" and are almost completely insensitive to moisture. When made into fabrics the synthetic fiber fabric possesses a far better elastic recovery than natural silk.

In the new patent, fiber experts at the National Bureau of Standards believed they had discovered the long-awaited and very important announcement. The Carothers patent (No. 2,130,948), with 56 broad and basic claims, describes the production of fibers from long chain amine compounds. These are prepared by reacting diamines and dibasic acids. Out of this reaction come acid salts which are crystalline solids having fairly definite melting points.

Eight specific ways of creating the new fibers are described. A typical reaction is a mixture of 14.8 parts of penta-methylene-amine, 29.3 parts of sebacic acid and 44 parts of mixed xylenols.

ELECTRIC POWER REQUIREMENTS OF THE UNITED STATES

THE sharp increase in electric power requirements in the United States during the World War years, 1915-1918, and the enormous difficulty with which the increased demand was met lie behind the work of President Roosevelt's commission now working out a plan to meet future war-time electric power needs.

Concentration of much of the recent growth in installed capacity in the West, while American industry is still largely concentrated in the East and Midwest, has given rise to the fear that the frequent breakdown of power supplies during the World War might be repeated should the nation go to war again.

Plans both for expanding generating capacity and for linking power plants by high transmission lines so that surplus power in one district might be used in another faced with a shortage or in the event of damage to power plants are expected to come from the commission.

Consumption of power increased 78 per cent. during the four years of the war. Much of the increase occurred while American manufacturers were busy filling allied orders, so that when America finally went to war existing spare capacity was already in use, thus helping to create the difficulties of 1917-1918.

Such an enormous increase in output would be more than equalled should war be declared, for war industries now include many that were only small users of electric power during war years. Electric methods of producing metals and other materials are more widely used than ever before and could not be changed.

American capacity at present amounts to more than

37,000,000 kilowatts. Production in 1937 was 121,000,000,000 kilowatt-hours. More than 28 per cent. of this total came from hydro-electric plants, an increase of but 2½ per cent. since 1920. Since hydro-electric developments are independent of fuel supplies and attendant transportation difficulties, they are the most desirable from the national defense point of view. According to the National Power Survey, a potential annual power output of 275,000,000,000 kilowatt-hours, more than twice the total output to-day from all sources, can be obtained from further hydro-electric developments.

Electric power production capacity has been increasing only relatively slowly during the last seven years, but has more than doubled since the World War. At the same time, it is felt, power requirements for a major war have increased at an even faster rate during that same period of time.

THE HURRICANE

NEW ENGLAND, digging itself out from under hurricane débris, can take what consolation it may from the fact that the storm of the twenty-first was the worst disturbance of tropical origin that ever struck its shores—was a high-power sea-blast even by Caribbean standards. Other hurricanes have visited the Northeastern seaboard in past years, the Weather Bureau informed Science Service, but never anything like this one.

A lazy high-pressure area, moving too slowly off to sea, was the indirect cause of New England's woes. Ordinarily, when a tropical storm center moving northward fails to make land below the Virginia Capes, it will veer off to the northeast and blow itself out at sea. But this one found itself stymied behind that loitering "high," like an impatient motorist behind a slow truck, and was forced to move straight northward and then even towards the northwest—with results already only too well known. When last heard from on Thursday, the storm was blowing itself out to exhaustion over the province of Quebec.

The storm center traveled at a motor-car speed. Usually, hurricane centers travel at a rather leisurely gait, despite the high velocity of the winds that blow inward towards them. But the center of this storm averaged a northward speed of 53 miles an hour from off Cape Hatteras until it was over Long Island. Probably during part of that time it was moving as fast as 60 miles an hour.

Despite the terrible record of death and destruction left by this storm, the present hurricane season has been a relatively light one. Thus far, there have been only four hurricanes detected in Caribbean and Gulf waters, and only two of these have been really severe—the one of Wednesday, and one a few weeks back that struck the Mexican coast near Tampico and did not figure much in American news, although it did a great deal of damage to Mexican shipping and shore works.

The greatest hurricane season of all Weather Bureau history was that of 1933. By late September of that year there had been 16 hurricanes, and at the end of the season the count was 21.—FRANK THONE.

ITEMS

RIVALING the Grand Canyon of Arizona in magnitude, a newly discovered submarine abyss cut into the ocean bottom off Carmel and Monterey, Calif., is described by Professor F. P. Shepard, of the University of Illinois, at present working at the Scripps Institution of Oceanography at the University of California. The subsea canyon is about 7,000 feet deep, and sections already traced have shown contours resembling those of the Grand Canyon of Arizona. Study now being conducted from the laboratory yacht *E. W. Scripps* includes soundings, dredging and readings of the water temperatures.

A LONG-STANDING blank spot on the map of Alaska will be filled in from the mass of air photographs and data now being brought back by the Harvard University-National Geographic Society Alaska Expedition. The area is only a little distance inland from Juneau, the capital of the great northwestern territory, yet until the coming of aviation as a means of geographic exploration it has remained as unknown. It is an area in a vast bowl of mountains, very difficult to reach even at its edge and impossible to cross. Prospectors who tried to take this apparent short cut during old gold rush days simply disappeared. The new expedition's exploring flights have dramatically shown why. The bowl is an ice bowl, the greatest area of glacial ice known outside the Polar regions. Many of Alaska's most famous glaciers are mere outlet trickles from this surviving piece of the Pleistocene. It is expected that it will be many months before new maps can be prepared showing accurately the features photographed in a few weeks by the expedition's fliers. But the map of Alaska will be different from what it has been in the past, and more nearly complete.

A NEW pain-relieving drug which may be the means of freeing the world from the poppy's bondage has been developed at the Medical School of the University of California. The drug, dinitrophenylmorphine, was first reported by Dr. Chauncey D. Leake, professor of pharmacology, at the meeting of the British Pharmacological Society at the University of Oxford. Collaborating with Dr. Leake are Dr. George Emerson, of the University of West Virginia, and Benedict Abreu and N. M. Phatak, graduate students at the University of California. The new drug, called DNPM for short, is a combination of morphine and dinitrophenol. The latter is a fever-producing drug which caused disastrous results and some deaths when used without proper supervision as a weight-reducing medicine. The new drug is said to have none of the action of dinitrophenol, but to be much more like codeine and morphine. Experiments on animals and normal human subjects show that it has pain-relieving properties and respiratory effects similar to morphine and greater than codeine. Animal experiments also suggest that it may be less habit-forming than morphine. Dr. Leake and associates pointed out, however, that any chemical which relieves pain and causes a feeling of well-being may become habit-forming in persons desiring to escape from an unpleasant health environment.

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SCIENCE NEWS

Science Service, Washington, D. C.

HIGH-SPEED ELECTRONS

HIGH-SPEED "bullets" from the "atom gun" at the University of Notre Dame are being used to study a strange bluish-white light which is found in liquids when they are bombarded with swift-traveling electrons.

This strange light, known as Cerenkov radiation, after the Russian scientist, P. A. Cerenkov, who discovered it in 1934, is produced when the electrons are traveling through a liquid with a speed greater than the speed of light in that liquid. The original discovery was made with beta-ray electrons given off by radium. These electrons come off with all sorts of speeds. While they were useful in creating the faint blue-white light in a liquid they could not be used for a quantitative study of the phenomenon.

According to a report in *The Physical Review*, Professor George B. Collins and Victor G. Reiling, therefore, took up the light's study, using electrons whose speed and energy were definitely controllable. Electrons having energies of 2,000,000 electron-volts from an electrostatic generator were used. These swift electrons were shot into a vessel containing a liquid and a small sheet of mica or Cellophane. The light produced was caught and analyzed by a spectrograph placed at right angles. Alcohol, benzene and water were the three liquids used.

It was found that the radiation was continuous and extended from the long-wave sensitivity of the spectrum plate into the region of the ultra-violet where absorption occurs in the particular liquid used. The intensity of the Cerenkov rays was found to be greater in the shorter wave-lengths than are rays produced by a tungsten lamp in the same region.

The theory of the origin of the rays had previously been worked out by I. Frank and Ig. Tamm, of Soviet Russia, from Cerenkov's original work. This theory was confirmed by the work at Notre Dame.

THE REBUILDING OF FORESTS IN
NEW ENGLAND

REBUILDING of the hurricane-ruined forests to their former estate as a prime natural resource is the task now being undertaken by New England as the people turn to the task of reconstructing their battered communities. Representing New England's forestry interests, Ward Shepard, director of the Harvard Forest, has been in consultation with the U. S. Forest Service, the Civilian Conservation Corps, the Works Progress Administration and other government agencies, discussing Federal participation in meeting the present emergency and in setting up a long-time reconstruction program.

At present, about half of southern New England's trees are down. What once were forests and farm woodlots are tangled heaps of splintered trunks and limbs piled like giant match sticks and waiting for sparks to turn a literal inferno loose. The second tropical disturbance, which on Friday and Saturday poured heavy rains

on the ruins, was a cause of thanksgiving to the anxious watchers, for it gave insurance against forest fires for a week or two.

In the meantime it is hoped to get the emergency fire-prevention program into operation. First step will be the recruiting of officers and personnel. U. S. Forest Service experts are already on the ground, and companies of the CCC and WPA are being moved up to the front. As far as practicable, emergency worker corps from adjacent states will also be moved into the area of action, and the knots of official red tape will be cut to the limit.

A five-fold scheme of attack has been laid out: (1) Forty-foot strips will be cleared of down timber along all highways. (2) Roads and fire-lanes will be reopened through the forested areas as fast as axes and saws can be plied. (3) Extra men will be put on fire patrol. (4) Fire lookout towers (they are all down now) will be rebuilt. (5) Down timber will be removed.

The last of these five jobs is of course the biggest and the most difficult to carry out. Yet it must be completed, with saw and axe where possible and with controlled burning where necessary, for the tangled heaps of dead trees are not only an immediate fire hazard, but they will in time come to harbor terrific concentrations of insect and fungus pests that will menace trees left standing and the new growths of timber that will soon spring up.

Not only that, but these blown-down masses contain a great deal of cash value if it can be salvaged. The wind took New England's biggest and best trees, which were in many cases the farmers' savings accounts. Government labor will salvage as many of these valuable trunks as possible, and government-backed credit will help the owners to market them gradually instead of dumping them in distress sales.

For the long pull, the U. S. Forest Service has been asked to aid in planning an entirely new set of woods for the devastated regions. All of southern New England's timberlands are privately owned; the only national forests are in northern Vermont, New Hampshire and Maine. This means that woodlands are predominantly in small parcels, and that the timber is of high importance to the farmer-owners. Credit and tax setups must be arranged with these conditions in mind.

One thing was emphasized by Mr. Shepard: In New England's new forests, growing conditions closer to those of nature will be sought than has been the practice in past years. The custom of growing evenly ranked masses of trees, all of the same species and all of the same age, which the world copied from nineteenth-century Germany, will be abandoned in favor of more naturalistic forests of mixed species and all ages.

Such forests, the hurricane showed, can stand against a high wind much more successfully than the uniform, even-aged cultivated timber stands. They are also more resistant to fire and to forest insect pests and fungus

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By WILLIAM SEIFRIZ, *Professor of Botany, University of Pennsylvania*

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By WILLIAM DOWELL BATEN, *Associate Professor of Mathematics, Michigan State College*

A well-balanced textbook for economics and business statistics students, for social science students or for students specializing in the natural sciences. Differential and integral calculus is not required as a prerequisite. The book attempts to develop formulas and fundamental relations by the use of very simple algebra, trigonometry and analytical geometry. Comparisons are presented for the purpose of distinguishing differences between the concepts of linear correlation, non-linear correlation and correlation based on the correlation ratio. Details have not been spared in the presentation of partial, multiple, and tetrachoric correlation. Ideas concerning sampling are developed by sampling from a finite parent population before going to the infinite.

330 pages; 5½ by 8½; \$3.00

An Introduction to the Vertebrates

By LEVERETT A. ADAMS, *Associate Professor of Zoology, University of Illinois*

In revising this book, the author has received the benefit of suggestions from a number of teachers who have used it in the classroom. As a result, numerous changes have been made. The material on comparative anatomy now comprises Part II. This section has been practically rewritten; those chapters that have been shown by classroom use to need expansion have been enlarged by the addition of considerable material. The original Part II now concludes the book. Many of the illustrations have been redrawn, and a number of new ones have been added. The bibliography has been enlarged, and the glossary revised. As the book now stands it offers, first, an outline of the characteristics on which the modern system of classification of chordates is based; second, a comparative analysis of anatomical systems and specialized structures; and third, a view of each of the five classes—fishes, amphibians, reptiles, birds, and mammals.

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diseases. Finally, they are better homes for game animals and wild birds, and pleasanter places for human recreation.

FRANK THONE

POWDERED METAL COINS

If the governments of the world wanted to save a lot of money they would make their coins, especially those containing precious metal, out of metallic powders.

No, the coins wouldn't fall apart into metal dust. Powerful presses would squeeze their powders together so tightly that the specks would cling together with all the strength of solid metal itself.

This suggestion of making powdered metal coins was advanced at the meeting in Providence on October 7 of the American Society of Mechanical Engineers by Gregory J. Comstock, of the firm of Handy and Harman, Bridgeport, Conn.

Cutting round objects out of flat sheets of alloy metal is a costly process, said Mr. Comstock, because there is so much scrap metal which must be sent back and remelted and then rolled out again into another flat sheet.

"Coinage alloys that include a precious metal require an extremely exact composition control, which adds materially to the cost of melting," Mr. Comstock told Science Service.

"Also when the weight of the coin depends solely upon the thickness of the sheet from which it is blanked, increased costs are involved in maintaining the necessarily exact gauges of the sheet from which the coin blanks are punched," he added.

Experiments have shown, he indicated, that over-sized machines like those which make aspirin and other medicinal tablets are admirably adapted to produce powdered metal "preforms" with surprising uniform weight at high speed.

"Alloyable mixed metal powders preformed in this manner and sintered in furnaces having controlled atmospheres," he pointed out, "could be coined to high density without involving the production of any scrap by the necessary removal of excess material."

The standards of exactitude for coins are no greater than are the requirements of accuracy now demanded for bearings which are, even now, being fabricated out of powdered metals in a similar fashion.

THE INCREASING USE OF RUBBER

THE much wider use of rubber as an engineering material in itself, and not in connection with other materials as it is now applied, was predicted at Providence, R. I., on October 5 by Dr. William C. Geer, research chemist, of Ithaca, N. Y., before the opening meeting of the American Society of Mechanical Engineers.

The use of rubber in the mountings of automobile engines and in mountings which prevent serious vibration in heavy machinery are applications pointing to the future fertility of the field of rubber's engineering uses, rather than indicating a fully developed science, said Dr. Geer.

Major advance in rubber technology, from the engineering point of view, is that the product is becoming very uniform for many different methods of treatment,

Dr. Geer indicated. It is now time to make extensive study on the larger engineering scale of practical research.

There is no such thing as a true synthetic rubber, declared Dr. E. R. Bridgwater, of the E. I. du Pont de Nemours and Company.

Synthetic rubber is a misnomer when applied to the many synthetic rubber-like substitutes which now are finding valuable uses for their special properties.

The man-made rubber-like materials are synthetic, it is true, he pointed out, but they do not duplicate the chemical structure of natural rubber in the same way that synthetic camphor duplicates, chemically, native camphor.

The rubber-like materials, Dr. Bridgwater indicated, differ widely in their chemical composition. In fact, he said, there is a wider difference between some of them than there is between certain of them and natural rubber.

STERN DESIGN FOR FAST SHIPS

A RADICALLY new type of stern construction, consisting of a pair of bulbous blisters, one on each side of the hull down by the keel, that both cuts down vibration and increases speed has been developed by the designer of the French liner *Normandie*, Vladimir Yourkevitch, it was learned here.

Capable of increasing the speed of a vessel by as much as a knot without altering the power plant, the new type stern achieves its greater efficiency by creating two "tunnels" that direct the flow of water to the propellers.

Vibration from the propeller, a representative of Mr. Yourkevitch, A. Chernow, declared, is reduced because of the greater stiffness of the bulbous construction as compared with the more conventional overhanging and cruiser sterns.

The new type of construction is being embodied in vessels designed by Mr. Yourkevitch and now under construction, it was learned. The naval architect is at present in Paris.

The new type stern is adaptable to the extent that it may be built into existing vessels, Mr. Chernow explained. It is covered by U. S. Patent No. 2,127,475.

Vibration due to the propeller is an extremely serious matter in high speed vessels, such as super-luxury liners and destroyers. One general solution to the problem is stiffening of the stern. The blisters developed by the Russian-born naval architect is one method of achieving that reinforcement. It is superior to the use of additional trusses or girders as much less weight is added to the stern and in addition greater speed is attained, or, as the case may be, a specified speed is reached with less power.

Blisters beneath the water line at the bow are also a development with which Mr. Yourkevitch has been identified. The *Normandie*, among other vessels, features them. Justification for the design is found by many naval architects in the fact that the *Normandie* is very little slower than the *Queen Mary*, even though the latter's engines develop 25 per cent. more power than the *Normandie's* power plant.

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The Yourkevitch stern blisters have been tested in testing tanks abroad, Mr. Chernow asserted.

Use of the blisters also makes possible an enclosed rudder, thus cutting down the likelihood of damage to the steering mechanism, he pointed out.

An additional advantage is that the blisters provide greater buoyancy at the stern, thus cutting down on the amount of "squat." Squat is a tendency on the part of the stern of a ship in motion to settle deeper than the bow, "thus causing a partial up-ending of the hull which, in case of an exaggerated squatting, increases its resistance to passage through the water," in the words of the patent.—LEONARD H. ENGEL.

COAL MINE DUST EXPLOSIONS

CLOUDS of inert rock dust form an effective way of preventing and limiting disastrous coal mine dust explosions, it is announced by the U. S. Bureau of Mines in Washington.

Coal miners may shortly see strange paper bags on little platforms near the ceilings of mines, if the new method, just investigated by the Bureau, is widely adopted.

The paper bags contain limestone treated so that it does not absorb water. When the first shock wave of an explosion sweeps down a coal mine and blows coal dust with it, the vibration makes these bags fall off their teetering platforms. A wire through the bag rips it open and down falls a dusty shower of inert rock powder.

This dust barrier wall, as it is called, has two functions. If it falls into coal dust so heated that it is about to explode, the rock dust will absorb heat and act to lower the temperature below the ignition point of the coal dust and thus help to prevent further explosion. Also the presence of a sizable mass of inert rock powder in the air helps dilute the coal dust and makes the explosion less severe.

In tests at the Bureau's experimental mine near Pittsburgh, Pa., it was found that the small bags of rock dust do not interfere with ventilation problems in a mine where the headroom is five feet. It was also shown that there is no injury to a person standing directly under the bags if they are made to fall accidentally. If the bags are accidentally broken in a ventilating shaft of a mine the rock dust thus blown throughout the mine is insufficient to cause interference with mine operation.

The tests show the bag barrier arrangement of dust is considerably cheaper than other, more elaborate, rock dust traps which the Bureau has tested. A mine operator will have to weigh a slightly lower efficiency against the lowered cost of installation.

ITEMS

THE chugging steam tugboat, familiar sight in every harbor in the world, has a new rival—a Diesel-electric powered tug with a drive similar to that employed on many streamline trains. The first of two new tow-boats, the *Thomas E. Moran*, equipped with geared Diesel-electric drive, has been launched at the Defoe Boat and Motor Works, Bay City, Mich., for a New York City transportation firm. Two eight-cylinder Diesel engines develop

1,350 horsepower and drive a generator that supplies current to a motor which, through reduction gears, transmits power to the propeller.

POWER output, fuel consumption and other relevant information can be obtained quickly by running the vehicle on the treadmill-like rollers, L. L. Fawcett, of the Auto Electric Company in Ponca City, Okla., told the Society of Automotive Engineers. A device that makes a record of how an auto or truck engine and chassis perform as the car rolls up miles of "travel" even though it stands still was suggested as a ready means of quick-check-up for trucks and automobiles. The device is the chassis dynamometer, a pair of rollers with suitable braking and recording devices. The vehicle is driven onto it so that the rear wheels rest in the "valley" between the rollers. It has the further advantage that the hood of the engine may be left up or a man may crawl beneath the vehicle to watch what happens when the car is running at different speeds and under different conditions.

SULFANILAMIDE, new and widely used chemical remedy for a number of serious ailments, speeds recovery from lymphogranuloma inguinale, sometimes called the fourth venereal disease. Sulfanilamide treatment of this disease was initiated at Fort Benning, Ga., by Colonel Guy L. Qualls, Medical Corps, U. S. Army, in the belief that the chemical would prove as effective for lymphogranuloma inguinale in humans as it had in the treatment of choriomeningitis in mice, both being virus-caused diseases. Encouraging results of this treatment were reported before the clinical staff at the station hospital by Lieutenant Gladen R. Hamilton, Medical Corps, U. S. Army. The first two cases which had been under ordinary methods of treatment in the hospital for 51 and 49 days, respectively, were returned to duty within a few days. To date 35 cases have been treated. The duration of the disease and the disability therefrom has been reduced from months to days. A detailed report will be made to the medical profession in a forthcoming issue of *The Military Surgeon*.

A SYSTEMATIC study of the normal, healthy student, in a search for the forces that make for a well, successful individual, has been undertaken at Harvard University. The research is a new attack on problems of health, and is expected to prove an important supplement to the traditional medical approach through study and care of illness. Collaborating in the investigation will be eight specialists in medicine, psychiatry, psychology, physiology, anthropology and social work, under the supervision of Dr. Arlie V. Bock, head of the department of hygiene. The study will be continued for at least five years and is financed by the William T. Grand Foundation. Students regarded by the staff as "normal" will be asked to volunteer as subjects. The total personality and constitution of each individual will be investigated, including such elements as heredity, family background and school life.

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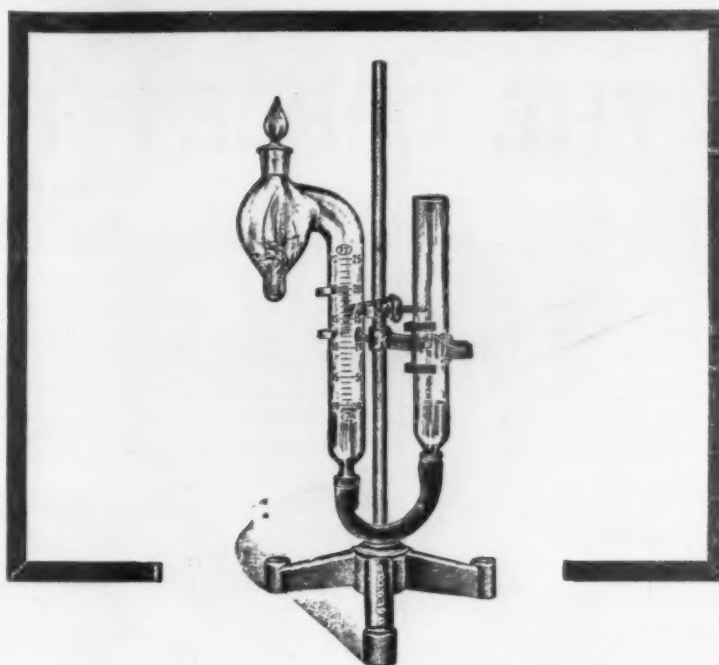
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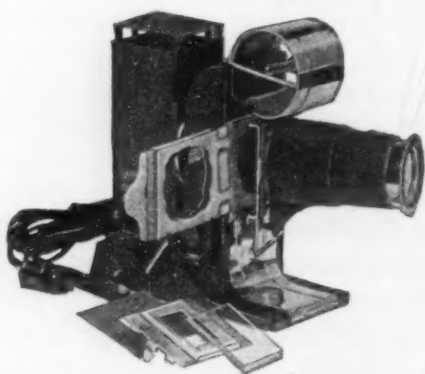
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This edition of a book considered since 1922 one of the outstanding textbooks in the field of chemistry, is designed primarily as the basic textbook of a second-year inorganic course. Since the last edition appeared, much progress has been made in various fields of chemistry. In the fourth edition, therefore, an attempt has been made to introduce students to material which they will use in their later college courses, and to eliminate that which is of interest for historical reasons only. Many of the chapters have been completely rewritten and others contain extensive revisions. "Chapin" makes an ideal textbook for students who have devoted their first year to acquiring a knowledge of the facts of chemistry, with little emphasis on principles.

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This book offers a discussion of optical principles of instruments, manipulative methods of general application, and the observation of physico-chemical phenomena. In this second edition the content has been extensively revised. New material has been added on such topics as special methods in photomicrography, the preparation of specimens, the interpretation of appearances and illumination methods, etc. The chapter on optical properties of crystals has been carefully revised, and diagrams added. A discussion of optical properties of doubly refractive tissues, fibers, and synthetic materials serves as a tool in the modern approach to these fields of investigation. One of the most important changes in the book is the addition of a new chapter on determination of particle size. The book abounds with specific illustrations of applications to technical problems and practice.

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SCIENCE NEWS

Science Service, Washington, D. C.

COSMIC RAYS

A NEW hypothesis involving cosmic rays in the origin and evolution of life on earth has been suggested by Dr. John Tandberg, of the Electrolux Laboratories in Stockholm. His suggestion goes much farther back in evolution than does the hypothesis of Darwin and other well-known concepts on the possible origins of life.

Dr. Tandberg suggests that the powerful and piercing cosmic rays, and the radiations from radium that were formerly much more potent on the earth, are the agents which brought forth life on earth. These rays turned aseptically organic molecules into strange, new forms of matter that could combine, eventually, to make those compounds out of which protein and other life-giving substances are composed. Life in animal and human form is characterized by the presence of compounds containing atoms of carbon and nitrogen.

In the waters of the oceans, in the primitive, lifeless world, the necessary complex compounds could have been built up, it is suggested on the basis of the new hypothesis.

The ocean's water at that time, Dr. Tandberg postulates, contained the heavy kind of hydrogen known as deuterium just as it does now. If this deuterium were bombarded with cosmic rays, or with the radiation released by radium in the ocean, there would be created those non-electrical particles of matter known as neutrons. With neutrons to go around knocking other atoms or molecules, Dr. Tandberg sets the stage for chemical evolution that might have led to complex organic molecules containing nitrogen and carbon. Suppose, he assumes, there existed in the ocean a molecule of carbon atoms arranged in a typical chain-like fashion. If one of the carbon atoms in this chain were struck by a neutron a nuclear change could be brought about which would create a stable atom of nitrogen in place of the struck carbon. Thus the chain would contain many carbon atoms and a nitrogen atom. Providing the chain molecule was not destroyed by this bombardment a new carbon-nitrogen linkage would thus have been built up. The new molecule, formed in this way, would be capable of new reactions which it did not before possess.

By the bombardment of silicon with neutrons it is possible, according to Dr. Tandberg, to create the essential element phosphorus also needed for life.

The evolution of more and more complicated molecules by bombardment would, of course, be a matter of chance but eventually—through the millions of years of the earth's existence—a happy combination of complicated molecules may have been brought about which would have eventually led to the first primitive forms of life on the earth.

Dr. Tandberg concludes: "Thus various complicated organic molecules containing, for example, carbon-nitrogen may have originated in a way rather different from ordinary chemical reactions and will perhaps have influenced the evolution of organic matter, eventually leading to the first primitive forms of living matter, no longer present on earth."

THE 200-INCH TELESCOPE MIRROR

THE great 200-inch telescope mirror for the Mount Palomar Observatory passed through a crucial stage when Dr. John Anderson looked it over with the delicate knife-edge test capable of detecting imperfections of a millionth of an inch.

Object of the test, which gave promising results, was to determine whether the huge polishing tool, which is large enough to cover the entire mirror, could do the job of turning the coarsely ground spherically curved disc into a highly polished one. This is one of the essential steps toward making out of the huge piece of special optical glass a mirror whose reflecting surface is in the shape of a parabola, necessary to bring the light from stars to focus.

Scientists charged with making the great mirror also had to know whether the 200-inch mirror and the huge polishing tool could be handled in the different grinding positions. It was determined that this can also be done satisfactorily.

The test for the mirror's spherical exactness was carried out by playing a point of light 110 feet from the face of the mirror, where the center of the complete sphere would be, and observing whether the mirror reflected the light right back to the center of the imaginary sphere. Any portion which failed to do so was not of the proper spherical shape, and unless it was very small would have to be worked over with polishing rouge until it was correct to a millionth of an inch. After the mirror has the proper spherical shape it will be used to test a 120-inch flat mirror, which will be utilized in figuring the spherical shape into a parabola.

RIVER IN THE SUBMERGED GRAND CANYON OF THE PACIFIC COAST

THE Pacific Coast's submerged Grand Canyon has a swift river that flows along its bottom, Professor Francis P. Shepard, of the University of Illinois, reported upon his return from an exploration of its course for 30 miles, off the shore from Monterey. Professor Shepard's present headquarters are at the Scripps Institution of Oceanography, University of California.

The great submarine canyon, which goes to depths of 6,000 feet and is actually contoured like the Grand Canyon of Arizona, causes a river-like flow by capturing and channeling ocean tides. This discovery was made through the use of a current meter. The tidal current scours it clean of mud.

The small amount of mud left in its bottom, as well as its other structural features, were studied by means of a new core-taking device invented by R. S. Dietz and K. O. Emery, with a special nose trap designed by Professor Shepard. The device consists of 600-pound streamlined weights, with a twenty-foot pipe and a friction-reducing nose. It drops to the bottom at a rate of thirteen miles an hour, and is capable of bringing up samples as deep as its length. The longest core brought up thus far, however, is twelve feet.

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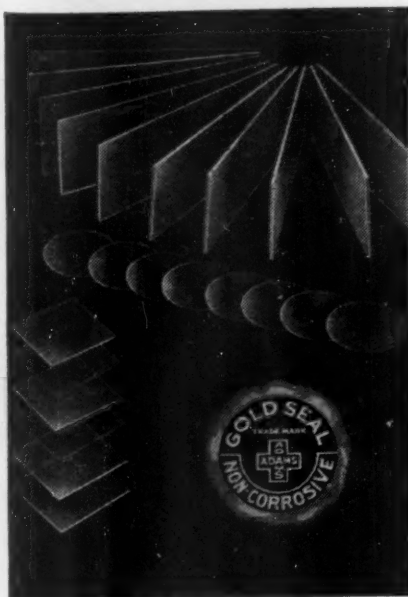
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Bottom samples thus obtained show that there is a very thin layer of mud on the bottom of the canyon, underlain by deeper strata of sand, rounded gravel, or rock. The water-worn gravel was probably formed when the canyon was a terrestrial river bed.

One wall of the outer canyon, where it resembles the Grand Canyon of Arizona, is formed of granite, overlain by sedimentary rocks of Tertiary age. The Tertiary was the long Age of Mammals, that ended with the coming of the Pleistocene or Ice Age a million years ago. Although the existence of the Monterey Canyon has been known for forty years, it is only now being explored in detail by Professor Shepard and his co-workers.

TAGGED IRON ATOMS

CURRENT theories about how the body uses iron for blood-building have been upset by studies with radioactive iron atoms, Professor George H. Whipple, of the Rochester, N. Y., University School of Medicine, reported at the Duke University symposium on medical problems.

Professor Whipple shared in a Nobel Prize award for his studies which led to discovery of the liver cure for pernicious anemia.

Liver still stands at the head of the list of foods that promote the building of hemoglobin and red blood cells in anemia, Professor Whipple said. He showed how this was learned from studies in which newly-formed blood and hemoglobin can be measured week by week in anemic dogs and the amount formed accurately determined as related to any given article of diet. After liver, kidney and other meat products stand high on the list of blood-building foods, whereas vegetables and dairy products stand low. Describing his latest studies with the tagged iron atoms, produced by the atom-smashing cyclotron of Professor E. O. Lawrence, of the University of California, Professor Whipple said: "The use of this precious material shows that many of our beliefs about iron absorption and utilization are incorrect. The anemic dog absorbs iron readily whereas the non-anemic dog, whose iron stores are adequate, absorbs very little if any demonstrable iron. The difference as shown by the use of radioactive iron is quite striking."

The way iron is transported in the body, long in dispute, will probably be cleared up by the use of radioactive iron atoms. Such atoms, because of their radioactivity, can easily be located anywhere in the body and their course through the body, along with untagged iron atoms normally taken into the body, can be detected. Within the first few hours after radioactive iron is given by mouth it is carried in the blood plasma in the non-protein part. Protein substances, more familiar as meat and eggs, are a necessity for the formation of hemoglobin, red coloring matter of the blood which carries life-essential oxygen through the body. Within a few hours the radioactive iron begins to appear in the protein fraction of the red blood cells. Whether this is associated with hemoglobin can not as yet be said.

VITAMIN B

"WHAT to do about vitamin B?" is a question making life harder for nutrition experts.

At the opening session of the American Dietetic Association at Milwaukee the vitamin B Complex—and it is complex—was put plainly before America's diet planners by Dr. C. A. Elvehjem, of the University of Wisconsin.

No less than six factors contained in vitamin B and all given tentative names and health functions were listed by Dr. Elvehjem, who said the splitting up of this vitamin has been figuratively like the explosion of a giant firecracker under it, leaving the scientists to pick up the bits.

One "bit" is riboflavin, which has been associated mainly with growth, but it is now gaining recognition as a factor against nerve degeneration. This particular part of vitamin B may be what is lacking when the nerves of beriberi sufferers are affected. Apparently, also, severe deficiency of this factor underlies cataracts rats get from nutrition deficiency.

Nicotinic acid, another of the "bits," is believed to be the main factor in vitamin B that figures—by its absence—in pellagra. Other food deficiencies may play a part in this disease, but "it does appear that the majority of the classical symptoms of pellagra respond to nicotinic acid."

Since, by one estimate, there are a million people in the United States whose food does not protect them against pellagra, Dr. Elvehjem added, "It is obvious that something should be done."

Whether millions of Americans should make up such deficiencies in vitamin factors at the grocery store or the drug store is a question on which dietitians must take a stand, pointing out that synthetic vitamins that can be taken like pills are here and clinicians find them valuable in many instances. At wholesale prices the cost of a daily requirement of riboflavin is four cents, nicotinic acid a tenth of a cent, thiamin one cent. "Personally," he added, "I prefer to consume my daily requirement of thiamin in the form of a pork chop, my riboflavin as a glass or two of milk, and by nicotinic acid as a small piece of liver. However, this does not mean that foods should not be fortified with some of the above compounds under certain conditions."

THE STABLE FLY AS A POSSIBLE CARRIER OF THE VIRUS OF INFANTILE PARALYSIS

STABLE flies and other biting insects should be reinvestigated as possible carriers of the virus that causes infantile paralysis, in the opinion of Dr. L. L. Lumsden, U. S. Public Health Service. Dr. Lumsden has been giving a series of lectures at the University of California at Berkeley.

Much work has been done on this theory in the past, but the theory was discarded because no vector of any kind has been shown to be capable of carrying the virus of the disease.

Dr. Lumsden contends that the essential causative factors of infantile paralysis are unknown and that work should be done to determine the possibility of a combination of biting insects as vectors, or carriers, and of lower animals as reservoirs of the infection. "Reports of recent observations and experiments by workers at the Univer-

sity of Bern, Switzerland, "Dr. Lumsden said, "appear to strengthen the suspicion that bovine and also porcine animals may serve at times as reservoirs."

The facts on which the theory of an insect carrier of the disease is based are that more cases of the disease occur in rural areas, proportionately speaking, and that it usually occurs at the season when infectious diseases like typhoid fever, yellow fever and malaria, in which insects play a part as carriers, are most numerous.

The fact that the disease in its epidemic form tends to confine itself to certain areas has called for much speculation regarding local causative factors, Dr. Lumsden said. Undoubtedly many humans in these areas who might be considered as carriers have traveled to other points without spreading the disease.

In some of the earlier studies, it was pointed out, scientists were able to transmit a form of the disease to monkeys from the stable fly, but these cases were so few that the fly theory was finally discarded as untenable.

ITEMS

OUT of super-heavy elements, created alone in the laboratories of science and not found naturally on the earth, comes a new radioactive transformation of matter never before known. By bombarding the heaviest element, uranium, for months with the atomic particles known as neutrons, the German physical chemists Drs. O. Hahn, L. Meitner and F. Strassmann, of the Kaiser Wilhelm Institute for Chemistry in Berlin-Dahlem have succeeded in creating the new transformation out of element No. 95, called eka-iridium. The eka-iridium, it is found, breaks down with a transformation having a half-life period of 60 days. It is believed that the bombardment of uranium by neutrons makes the latter penetrate into the uranium atoms and builds up elements, heavier than uranium (No. 92) which exist for only brief periods of time. In this way artificially-created atoms probably up to atomic number No. 97 have been created. The German report appears in *Naturwissenschaften*.

If salmon were as constantly visible as robins or bluebirds, they would be as celebrated for their skill in building nests and their vigilance and valor in defending them, it appears from a study reported to the Smithsonian Institution by Dr. Leonard P. Schultz, curator of fishes in the U. S. National Museum. The female of the salmon species does all the nest building. She is very skilful in the way she lets the water carry away the sand and gravel she scoops up with sidewise scrapings of her body, leaving a saucer-like depression in the bottom. After she has deposited part of her eggs and the male has fertilized them, she covers them over with gravel and then scoops out another nest immediately upstream. Some of the gravel from the second digging helps to protect the first nest. Both male and female fish guard the nest.

A NEW instrument, the adaptometer, which detects night blindness within eight minutes, has been developed by Dr. J. B. Feldman, of Philadelphia. Night blindness, believed responsible for many of the thousands of fatal automobile accidents that occur after dark, is an inability of the eye to adapt itself to dim light. It can generally

be remedied by intensive dosing with vitamin A or by a diet rich in the food sources of this vitamin, such as dairy products, green vegetables and carrots. Exposure to glare or strong light bleaches out the visual purple, a substance in the retina of the eye necessary for sight. When sufficient vitamin A is present, the visual purple is regenerated and the individual can see again. The adaptometer measures the speed of this regeneration. For normal persons it does not exceed five minutes. Any more than that indicates the presence of night blindness. The person being tested fixes his eyes on a strong light in the upper part of the adaptometer. After three minutes this bright light is turned off and the person is apparently in darkness. However, a very weak test light is automatically turned on when the bright light is switched off. If the person can not see this weak light within five minutes, he has night blindness.

WPA WORKERS, engaged in almost every conceivable type of activity, are being employed in New York City to work out highly complex mathematical tables of importance not only to mathematicians but to all sciences dependent upon mathematics. They have already completed computation of the value of the function e^x at intervals of .00001 for x ranging between -2.5 and 2.5 and are working on other tables as well under the direction of Dr. Arnold N. Lowan of Brooklyn College. The work is of an essential type, but of such a large order that no individual scientist is ordinarily capable of its execution. Sponsor of the project is Dr. Lyman T. Briggs, director of the National Bureau of Standards.

THE first "light conditioned" railroad car in the United States, equipped with Polaroid variable density windows, has been placed in service on the Union Pacific Railroad's "City of Los Angeles," a streamliner. Passengers in the car, fitted out as an observation car, can now control the brightness of light coming through the window by turning a knob. Only one of the two "City of Los Angeles" units is thus far equipped with the car. The windows are made of a polarizing material, which cuts out light vibrating in one plane. By rotating the Polaroid 90 degrees all the light can be cut out, with varying amounts in between depending upon the amount of turn.

SUCCESSFUL development of a tiny radio tube whose possible applications include mechanical "ears" for the deaf that are four times as sensitive as present types and police and foot soldier radio receiving sets has been announced by the Hytronic Laboratories at Salem, Mass., after two years of research. Developed primarily for the construction of an improved hearing aid, the miniature tubes are one and five eighths inches long and nine sixteenths of an inch in diameter. Hair-like filaments, small grids and other parts correspondingly small make the use of magnifying lenses necessary during manufacture. The tubes operate from a small battery no larger than flashlight cells. It can be incorporated into a hearing aid no longer than four inches. Operating on a filament voltage of 1.4 volts, the tiny tubes have a drain of .070 amperes. The tubes are made in a triode, tetrode, input pentode and output pentode.

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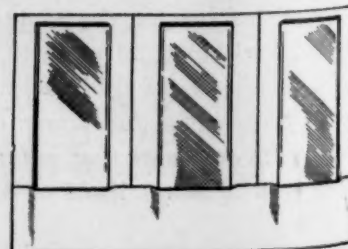
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SCIENCE NEWS

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SUN SPOTS

STORMY weather on earth, though it has laid whole states waste, is as nothing compared to what is happening on the face of the sun right now. If you will take a piece of well-smoked glass, or a couple of old photo films, and look at the sun, you will see a huge freckle near the middle of its face.

That freckle is an enormous sun-spot, representing a pair of fiery tornadoes that darken a strip of solar territory 100,000 or more miles long, and 50,000 miles wide at the widest part. Into that vast cloud half-a-dozen earths could be dropped at once, and still leave room for them to rattle around.

The spot has been studied and photographed, since its first appearance around the edge of the rotating sun about a week ago, by Mrs. L. T. Day, astronomer at the U. S. Naval Observatory. It first showed up on her photographic plates on October 5, and was due to disappear around the opposite side of the sun about October 18 or 19. If it lasts through another rotation of the sun, it should reappear about November 2.

There is some suggestion that this spot was "budding" a month ago, Mrs. Day said. There was a small spot in about the same position on the sun's face on September 16.

Sun-spots are an indication of intense activity on the sun, which is often reflected here on earth by magnetic storms. These storms are unobserved by human beings, because our senses have no way of perceiving magnetic changes. But they do affect us just the same, because they seriously interrupt telegraphic and radio communication, and are frequently accompanied by flaring auroral outbursts.

There was a magnetic storm at the time the smaller spot of mid-September crossed the sun's meridian or central line. Already, the present spot has signalled its coming, with minor upsets in communications on October 8 and 9.—FRANK THONE.

NEW COSMIC RAY STUDIES

TREMENDOUS bursts of atomic energy, caused when cosmic rays come down to earth, may scatter atomic debris over a room some 65 feet on a side, it is concluded in new cosmic ray studies announced in the current issue of *Nature*.

Physicists of the University of Manchester, Drs. L. Jánossy and A. C. B. Lovell, report studies in which they made cosmic ray bursts, or showers as they are called, take their own pictures in a cloud chamber. Only when cosmic ray particles set off "trigger" mechanisms placed over 15 feet apart were photographs of the tracks taken.

It is estimated that some of the bursts of atomic catastrophe contained 30,000 separate tracks. They conclude that the total energy of a single burst could be as high as 10,000,000,000,000,000 electron volts. This energy, of 10,000 trillion electron volts, far surpasses any efforts of man to create high energy with machines. The peak energy now obtained from atom-smashing machines like

cyclotrons is less than 15,000,000 electron volts. Even the great cyclotron now being built for Professor E. O. Lawrence at the University of California will yield particles having energies of only 50,000,000 electron volts. At 10,000 trillion electron volts, the cosmic ray energy is something like a billion times greater.

SOUND REPRODUCTION

A NEW method of sound reproduction that combines the advantages of mechanical recording and optical reproduction for talking motion pictures has been developed by a Dutch inventor and laboratory scientists of the N. V. Philips Gloeilampenfabriken of Eindhoven, Holland, the European electrical equipment manufacturer, has been reported to the Society of Motion Picture Engineers of New York.

Invented by J. A. Miller, the new method uses a wedge-shaped cutting tool to remove varying portions of a black-coated film, leaving a transparent sound track suitable for reproduction in precisely the same manner as the more conventional photographically-recorded motion picture sound track.

Advantages claimed for the system include freedom from ground noise, a difficult problem with ordinary optically-recorded sound tracks; possibility of playing back the sound track immediately without further processing, a matter of advantage on the studio set; and freedom from fogging, another difficulty with which recording engineers must deal.

The special sound track used for making the record by the "mechanographic process," as this has been named, consists of an ordinary film base covered by a layer of gelatin 60 microns thick topped by an opaque black coating. The wedge, whose shape is so calculated as to give an amplification of 40 times, digs more or less deeply into the film in accordance with the frequency of the sound being recorded. But since the tool is wedge-shaped, it also cuts a wider or narrower furrow. The portions from which the black coating are removed are thus transparent, giving a black-and-white track a photoelectric cell and amplification equipment can convert into sound.

Freedom from ground noise comes from the fact that ordinary photographic grain does not occur and the opaque coating is solidly black. The record is ready for playing back within a quarter of a second; a motion picture director, therefore, can thus replay anything he wishes immediately to see how it sounds. If he doesn't like it, he can record that passage over again on the spot.

Mr. Miller hit upon the principle in 1931. He then asked the Philips laboratory for aid in developing the invention, now known as the Philips-Miller system, to practical usability.

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The unique part of the set-up is the spring cartridge which fires the wire out when it is required. Trailing antennas are not new in aviation, but all previous ones have used a small cloth sleeve that catches in the air stream to help pull them out. This wind sock, as it is called, unfortunately means that there is no fine point in the system from which the static electricity may be discharged.

Paradoxical as it may seem, aviation's advance is in some respects to blame for the necessity for such a device. Improved streamlining has eliminated the sharp points from to-day's airplanes. But the old ships which did have the sharp points didn't make the extensive use of radio that now characterizes aviation. The cartridge is fixed at one end of the horizontal stabilizer on the tail surface. It is "fired" by the pilot by throwing a switch when static gets bad enough to warrant its use. Throwing the switch shunts the entire load of the plane's battery into the trigger mechanism, burning out a fuse that sets the trigger off.

About \$30,000 was spent in the development of the device. Among those playing a leading part in the work were Professor R. H. George, of Purdue University, and Herbert Huecke, then superintendent of the line's radio laboratory and now with the Civil Aeronautics Authority. It was flight tested on a Boeing 247D 10-passenger transport converted by the line into a flight research laboratory. The plane literally bristles with this antenna and nearly a dozen others of several different types. The cartridge is about six inches long and two inches in diameter.—LEONARD H. ENGEL.

AMEBIC DYSENTERY

THE lives and health of millions of people in this country are endangered by the germs of amebic dysentery, was reported recently at the Duke University medical symposium. Amebic dysentery was a matter of nationwide concern when an epidemic of it, causing many deaths, afflicted visitors to the Chicago World's Fair and residents of the city in 1933.

According to a statement made by Dr. Charles Franklin Craig from 5 to 10 per cent. of the population of the country is infected with the germ or parasite of this disease. In some parts of the country from 30 to 40 per cent. of the population is infected with this germ, *Endamoeba histolytica*. Liver abscess, resulting from this infection, may affect from 300,000 to 600,000 persons in the United States, Drs. Alton Ochsner and Michael DeBakey say as a conservative estimate.

Since liver abscess represents only about half the complications of the condition that require surgical attention, it is estimated that from 500,000 to 1,000,000 persons may be affected by surgical complications of the infection. The figures do not, apparently, account for countless other persons who may have complications requiring medical treatment.

Appendicitis, massive hemorrhage, perforation of the intestines with resulting peritonitis, brain abscess, spleen abscess, lung affections and skin ulcers and abscesses are a few of the twelve conditions, including liver abscess, that are listed as complications from infection with this parasite.

The vast majority of these infections are not accompanied by symptoms of dysentery, Dr. Craig pointed out. Dysentery is characteristic of serious infection, but most infections have with *Endamoeba histolytica* milder symptoms which are generally mistaken for signs of some other condition. To avoid confusion, the infection should be called amebiasis and not amebic dysentery.

The infection is by no means limited to the tropics and while it is most prevalent in the southern states of our country, enough occurs in the North so that public health officials and physicians should be on the look-out for it and should plan control measures. Liver abscess following amebiasis occurs chiefly in adults and chiefly in men. The latter fact may be accounted for, it has been suggested, on the grounds that alcoholism, which predisposes to liver inflammation and injury occurs more often in men than women.

SULFANILAMIDE

SULFANILAMIDE, new chemical remedy that has already saved thousands of lives threatened by pneumonia, meningitis, childbed fever and streptococcus infections, is to be used next in a major offensive against blindness, especially among children. This developed at a conference in Washington of eye specialists with medical officers of the U. S. Bureau of Indian Affairs.

The particular form of blindness to be attacked by sulfanilamide is that which results from trachoma, the contagious eye disease that afflicts between 2,000 and 3,000 new victims each year in the United States. About 17 out of every 100 persons who get trachoma go blind. Quarantine regulations forbid the entry into the United States of any person suffering with trachoma, but cured cases are allowed to enter.

Dr. Fred Loe, of the Indian Bureau, stationed at Rosebud, S. D., reported that out of 140 trachoma patients treated with sulfanilamide, 114 were apparently cured. Other eye specialists have reported similar encouraging results, especially in acute stages of the disease. Dr. Loe says it is too early to call these cases "sure cures," because there may yet be relapses, but symptoms of the disease have disappeared in the patients treated and those not already permanently blinded can see again. One 47-year-old man reported he saw more than ever before during his entire life.

Encouraging results with sulfanilamide treatment have led to plans for its large-scale use among Indians, of whom some 30,000 suffer from the disease. As soon as arrange-

ments can be made, probably by November 1, sulfanilamide treatment will be started among all child victims of the disease at the Tung River, Mont., Indian Reservation. At one school of 130 pupils there, 84 cases of trachoma have been reported. Children with trachoma at other Indian schools will be given the treatment as soon thereafter as arrangements can be made. The schools at Chenawa, near Salem, Ore., and at Fort Defiance, Ariz., are slated for inclusion in the drive on trachoma with this new weapon.

Adults are not being neglected, but the drive is being started among children because they can be reached through the schools and given continuous treatment there, and also because there is some tendency for the condition to "burn itself out" in older patients.

Trachoma, recognized by Egyptian doctors centuries before the Christian era, is more wide-spread among Indians than whites in the United States. Navajo Indians are particularly afflicted with it. The condition starts with little soft lumps on the eyelids. Inflammation, discharge and a thick fleshy film growing over the eye follow. This film blocks vision, and the scars it leaves when it subsides may cause permanent blindness.

FOREST FIRES

FOREST fires like the great conflagration now raging on both sides of the U. S.-Canadian border near the head of Lake Superior, can kill men and animals long after the last red embers have died out and new green growth has begun to hide the wide black scars. How this delayed death can come to burned-over timber country is told in the forthcoming issue of the *Journal of Forestry*, by Hoyes Lloyd, superintendent of wildlife protection in the Canadian National Parks.

In past years, great forest fires of unknown origin devastated large areas in northern Ontario. When new growth came in, it was not the same kind of trees that had been burned, but a vegetation type representing an earlier stage in ecological succession. This is usual after forest fires.

The new vegetation, in its turn, supported an entirely different array of animal life; it was the home of deer instead of the caribou that had dominated the animal community of the burned forest. Some have said that the caribou migrated, but Mr. Lloyd believes that the animals that survived the fire simply failed to reproduce, and that the caribou just weren't anywhere any more.

On the caribou a population of Indians, estimated at 10,000, once depended for their principal food supply. These Indians were fairly prosperous, and it was profitable for the whites to operate trading posts among them. After the caribou vanished, however, starvation among the Indians became the rule rather than the exception. Their population dropped to a tenth of the original number and their prosperity vanished. The trading posts had to be closed.

The story is the same in other regions, Mr. Lloyd declares. Where "big woods" are burned, "little woods" take their place, and their game population is quite different. It is usually dominated by deer. But if the fire follows logging-off operations the burning is apt to be repeated several times, and the scanty vegetation that

comes in is so little able to support animal life that the region becomes comparatively a biological desert.

ITEMS

To Dr. Francis A. Jenkins, associate professor of physics at the University of California goes the honor of making the first scientific use of the giant 225-ton atom smasher cyclotron here, it is announced. Designed to smash atoms and produce radioactive elements in quantities sufficient for biological experimentation, the new cyclotron is still four or five months away from first tests of its atom-smashing ability. But Dr. Jenkins employed its powerful electro magnets, now finished, to generate a strong magnetic field and make studies of the splitting of spectral lines by the field.

CIVIL engineers will build a suspension bridge span over two miles long if and when there is a demand for it, and enough automobiles to pay for its construction through tolls. Such a bridge would dwarf the present giant 4,200-foot span across the Golden Gate at San Francisco. This prediction was made at the Rochester meeting of the American Society of Civil Engineers by D. B. Steinman, consulting engineer of New York City.

ALUMINUM ore deposits that rank among the largest in the world are among the things that give Hungary outstanding importance in Europe's present state of military and economic turmoil. Professor Quentin D. Singewald, of the University of Rochester, describes these bauxite beds in the November issue of *Economic Geology*. Although the ore bodies were discovered in 1915, they were not worked until recently. Production was negligible before 1932, yet it reached nearly half a million tons in 1937, and is now pressing close upon the bauxite production in France, for some years the world's outstanding leader.

A SHORT-CIRCUITING operation to relieve chronic watery eyes was reported by Dr. William H. Stokes, of Omaha, Nebr., at the meeting in Washington of the American Academy of Ophthalmology and Otolaryngology. When infection or inflammation permanently blocks the tube through which the tears naturally leave the eye after bathing it, Dr. Stokes cuts a new opening from the tear sac into the nose. The operation is not new, but Dr. Stokes has improved it by placing the short-circuit higher than has been customary before. In this way he uses more of the normal lower end of the tear sac and upper end of the duct. The result is closer to nature's own tear drainage arrangement.

IN the German popular science journal, *Die Umschau*, Dr. Werner Hofmann, official food chemist of the Bakeries Institute in Berlin, tells of his efforts to find replacements for the fats now used in the baked-goods industries, and to reduce the total quantities used. Among the substitutes he mentions peanut oil, palm oil, soybean oil, even whale-oil. It was necessary to harden all of them by hydrogenation before passable results could be obtained. Soybean oil, from which great results were anticipated, proved especially disappointing. The oil has a persistent, strong, "beany" taste; also it tends to come out on the crust, making the products "greasy and messy."

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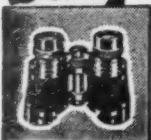
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SCIENCE NEWS

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HAWAII DURING THE AGE OF GLACIERS

RECENT geological researches indicate that Hawaii had its own ice cap during the Age of Glaciers. At the same time one of the islands, Lanai, was sunk almost 1,200 feet into the ocean.

Ice-carved lava flows indicate that Mauna Kea's lofty but sleeping volcanic peak had an ice cap during the time when America's northern regions and high mountain ranges were covered with glaciers. Studies of the summit by Dr. Herbert E. Gregory, of the Bishop Museum, and Dr. Chester K. Wentworth, of the Honolulu Board of Water Supply, assisted by local ranch managers and the United States Army, show that ice crept down from the summit, almost 14,000 feet above sea-level, to about 10,500 feet above sea-level, where it deposited moraines similar to those found in other glaciated regions.

Snowline during the ice age, the authors report in the *Bulletin* of the Geological Society of America, was depressed to about 12,000 feet above sea-level, while to-day, with the ice retreating rapidly in most parts of the world, the summer snowline in Hawaii would stand at 15,000 feet, if the mountains were sufficiently high. Quite active before the coming of the world-wide cooling of climate that produced the Pleistocene ice ages, Mauna Kea shows no evidence of activity during the intervals between ice advances and has erupted only mildly since the ice retreated.

Only a short distance from Mauna Kea, on the island of Lanai, Dr. Harold T. Stearns, of the U. S. Geological Survey, found that the arid shoreline of the lava islet had once stood 1,200 feet higher than at present, and had fallen in a number of steps to the present level.

Describing his researches in the *Bulletin* of the Geological Society of America, Dr. Stearns states that the island has emerged from the sea at an irregular rate, forming definite beaches when it was submerged 1,200 feet more than at present, another when it was under water by 560 feet more than it is now, a series of beaches from 560 to 250 feet above sea-level, and a pronounced beach at 250 feet above sea-level. Only 95 feet above present sea-level are a series of sea-deposited conglomerates, attesting to a shoreline at that level in the past. Below present sea-level, submerged shorelines tell of sea-levels lowered 300 and 60 feet, perhaps during the ice ages. The evidence suggests that all the Hawaiian Islands were submerged and then elevated during the past. The changes in shoreline are too great to be explained by changes in sea-level caused by the growth and shrinkage of polar ice caps during the Pleistocene ice ages, although the later, lower terraces may be the result of this.

THE THIRD JAVA APE-MAN SKULL

A NEW-FOUND skullcap of *Pithecanthropus*, ancient ape-man of Java, is unique in showing a marked resemblance to the skulls of the Peking race found in caves in northern China. This resemblance consists in a noticeable arching or doming of the top of the skull,

which is not present in the two previously known *Pithecanthropus* skulls, one discovered in 1937 and the other in 1891.

The new find is described in *Nature* by Dr. G. H. R. von Koenigswald, who works under the auspices of the Carnegie Institution of Washington, and Dr. Franz Weidenreich, of the Peiping Union Medical College, leader of researches at the Choukoutien caves, where remains of Peking man are found.

The third *Pithecanthropus* skull, like its two predecessors, is a large fragment. It consists of the complete right parietal bone, which makes up most of the side of the skull, with part of the left parietal and a piece of the occipital bone, which forms the back of the skull.

The fragment exhibits a crest along the top and a depression on the side, which "entirely correspond to those which are characteristic of the *Sinanthropus* skulls. The pronounced flattening of the cap, so specific for the two *Pithecanthropus* skulls known hitherto, is completely missing in the case of this new *Pithecanthropus* skull."

On the other hand, the new skull has certain features in common with both Java and Peking skulls, especially in a general lowness of the entire cap as compared with the higher doming in skulls of modern man, and in having its greatest width at the sides of the face just forward of the ears, instead of much higher up, as in present-day races. The condition of the sutures or seams between the bones indicates that the skull is that of a juvenile individual.

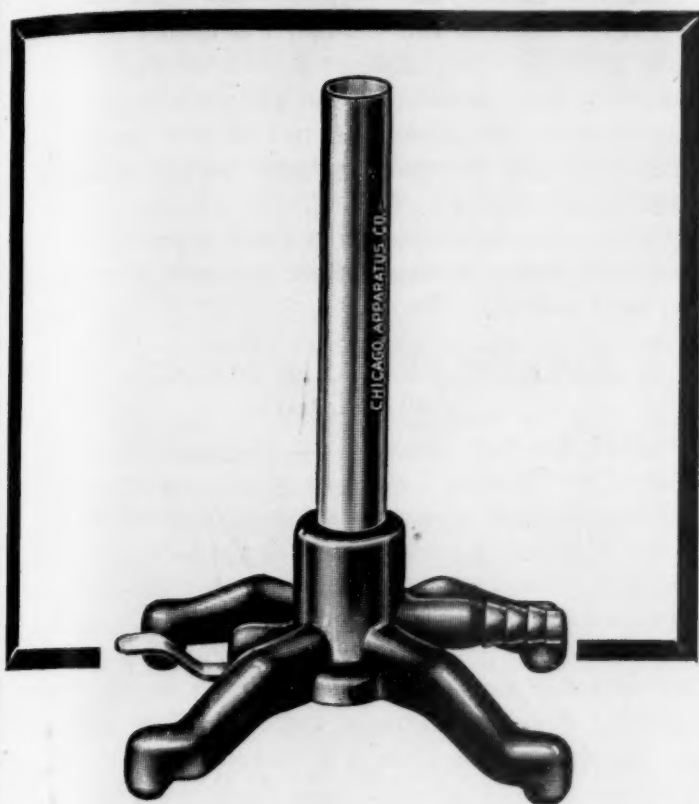
It is pointed out in conclusion that "All the new *Pithecanthropus* finds demonstrate how important and promising it is to search for fossil man in Java."

THE USE OF GAS IN THE ERADICATION OF PLANT DISEASES

AMERICA'S great tobacco crop has been saved from its most menacing enemy by a gas warfare method, and the way opened for application of the same method in attacks on other plant diseases, by investigators at Duke University and the Virginia Agricultural Experiment Station in cooperative investigations.

Blue mold, or *Peronospora tabacina*, which is a plant itself, was singled out of several thousand plant diseases for special investigation. It works only in darkness, preferably between midnight and daylight. Like certain human diseases, it thrives best upon a healthy living host. Its dust-like reproduction bodies, or spores, are scattered far and wide by the winds, or fall to the ground in leaves and there lie in wait for any tobacco plants which unsuspecting farmers may plant in the infested soil. The wind-borne spores, which scattered from Florida to Canada last year, send out feeding tubes into any part of the tobacco leaf, even the hairs, but only when dew or water is on the leaf. Although it sometimes appears in the fields, in early spring, its greatest destruction is to be found in tobacco seed beds.

When sprays were applied, their disinfecting action did not always reach the microscopic spores. Almost



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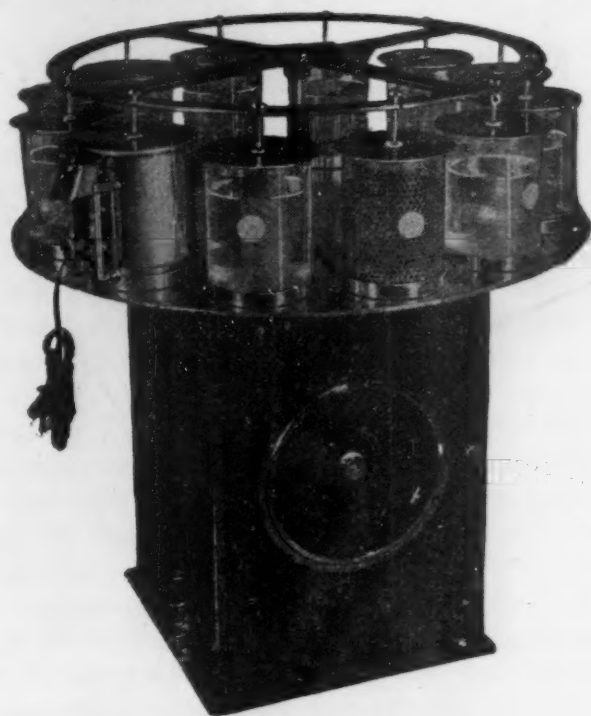


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simultaneously, investigators in Australia and at Duke University realized that new technics in plant protection were necessary. Gas was the logical answer, gas that would penetrate to all parts of the plant above ground and cover all exposed surfaces. Several chemicals were tried. Some destroyed the seed beds like fire, some were ineffective. Benzol, xylol and tolulol, hydrocarbons distilled from coal, were effective. But an accident occurred: a seed bed upon which investigations were being conducted was destroyed. So the work was taken to the laboratory. Plants were grown in glass jars, temperatures were regulated, benzol vapor concentrations were precisely controlled and checked by gas analysis technic.

The effect of benzol on tobacco seedlings was minutely studied. Working night and day, it was determined precisely how much benzol was required to cause injury to tobacco seedlings. Over 1,000 square yards of tobacco beds in North Carolina and Virginia were fumigated. The tricks of the parasite were learned in the cold, wet nights of early spring. Time after time, the blue mold was destroyed on the second night of fumigation.

For the first time a method was demonstrated which would kill the parasite without harming the plants. The disease could be held in check with one thirtieth the amount of vapor required to destroy the plants. One sixth of the amount of gas lethal to the plants would completely destroy the fungus after the second application. This discovery is important. A chemical has been discovered that would harmlessly penetrate the tissues of the host and yet destroy the parasite.

THE BIRTH AND DEATH RATES IN THE UNITED STATES

AMERICA'S rate of population increase is up to six per 1,000 people. More babies are being born in the United States this year than there were in 1937, and fewer of them are dying. Fewer of all of us are dying, as a matter of fact. There is a pretty good chance that, in spite of the "little depression," American health figures for the year will set a record.

A survey for the first half of 1938 has been published by the U. S. Public Health Service. It states that "Another outstanding feature of the mortality record for the first six months of 1938 was the wide-spread decline in the infant mortality rate. Only five states reported a higher rate than for 1937, and the current rate is nearly nine per cent. less than that for last year. The birth rate for 1938 has continued slightly above that for 1937. This increase, combined with a lower death rate, has resulted in a crude rate of natural increase of 6.0 per cent. per 1,000 population, compared with the corresponding rate of 4.3 per 1,000 population for 1937."

For the population generally, the same six-month trend, if carried through the remainder of the year, will place the country's mortality rate at the lowest point on record, with the possible single exception of 1933. The rate for the first six months of 1938, 10.8 per 1,000 population, is only slightly higher than the low rate for 1933 and represents a decrease of 8.5 per cent. from the rate for 1937.

The drop in the influenza-pneumonia death rate is an important factor in this decline; but almost all diseases show similarly steep declines in the numbers of their victims. Improvements in the tuberculosis and maternity mortality situations are cited as most encouraging. The campaigns for greater traffic safety seem to be succeeding.

Cancer, however, continues its ominous creep; mortality from this disease increased three per cent. over that for the same months in 1937.

BAUXITE ORE AS A SOURCE OF ALUMINUM

A WAY has been discovered in the electrochemical laboratory of Columbia University to use low-grade bauxite ore from Italy as a valuable source of aluminum.

The discovery potentially breaks the semi-monopoly of the few sources of commercially acceptable high-grade bauxite ore. This bauxite ore has been a highly important "strategic" mineral in the maneuvering of nations for economic supremacy. In a report to the Electrochemical Society, Professor Colin G. Fink and V. S. de Marchi describe their new method of removing the excessive amount of iron oxide from low-grade Italian bauxite and producing, on a practical scale, a residue which will yield shining aluminum.

Bauxite is the name of rock containing hydrated alumina mixed with various oxides. White bauxite, very rare, is rich in alumina and low in iron oxide. It is used in ceramics and in the production of artificial gems. Red bauxite, more widely distributed, is used in the production of aluminum. Ferruginous bauxite, very abundantly distributed in nature, contains so much iron oxide that it is not commercially used at present.

It is with this third type of bauxite that Professor Fink and Mr. de Marchi worked. Their aim was to discover a way to remove most of the iron oxide and make possible the use of the once valueless ore as a source of commercial aluminum. Moreover, they sought to refine red bauxite and bring it into the class of the rare, white bauxite.

Chemically, the steps in the new process consist of treating bauxites with high iron content with an excess of sulfur at high temperatures. By this treatment the iron oxide is converted into iron sulfide. The excess sulfur that does not react is boiled off. Along with the change of iron oxide into iron sulfide the presence of sulfur changes over the other impurities present, titania and silica, into their sulfur compounds. These sulfides are then treated with an excess of chlorine and aluminum chloride results.

It is reported that "The chlorination of the sulfided Istrian bauxite at 600 degrees Centigrade removes 90 per cent. of the iron oxide, over 50 per cent. of the titanium dioxide and 14 per cent. of the silica. The alumina losses were only 9 per cent. The reaction is complete within the first five minutes of chlorination. If the chlorination . . . is carried out at 920 degrees Centigrade, 94 per cent. of the iron oxide and 66 per cent. of the titanium oxide are removed. The alumina losses are only 7 per cent."

THE NOMENCLATURE OF COLORS

SCIENCE is nearing the end of its task of trying to set up a few simple names for colors which will bring order out of the more than 2,000 designations which colors now have.

In a report to the Niagara Falls meeting of the Optical Society of America, Dr. Deane B. Judd, of the National Bureau of Standards, stated that only a few revisions remain in the task of finding 320 designations for all colors.

Actually only a few names are needed in the system devised by the Inter-Society Color Council. Eight adjectives—strong and weak, light and dark and pale, deep, dusky and brilliant—are applied to each hue name to make up the total number of 320.

The names agreed upon are: pink, red, orange-pink, red-orange, red-brown, orange, brown, yellow-orange, yellow-brown, yellow, olive-brown, olive, yellow-green, green-olive, green, blue-green, blue, purple-blue, purple, purple-pink, red-purple. And in addition, white, grey and black.

The scientific classification of colors, Dr. Judd said, was undertaken at the request of the American Pharmaceutical Association to simplify the color designation of drugs and chemicals.

In its broadest aspects the new system of simplified colors could be applied to all fields of activity where colors are used. However, manufacturers might be adverse to putting out a color known as a "weak" pink or a "weak" blue, even if it is scientifically accurate. Thus Twilight Mauve, Titian Tan, Patio Blue and the other new fall shades will probably continue in use.

A NEW MILKING PROCESS

A NEW milking process, in which air is excluded from all steps, all the way from cow to bottle, has been invented by Burgess A. Lee, of Lockport, N. Y., working in collaboration with Professor Oscar Erf, of the Ohio State University. Milk obtained by this process is claimed to be protected against losses of calcium and vitamins that occur when the fresh-drawn milk is exposed to air.

Milk as it comes from the cow's udder contains two gases in solution, nitrogen and carbon dioxide. Contact with oxygen is stated to cause precipitation of calcium salts and loss of vitamin constituents. This loss, according to Professor Erf, is responsible for the failure of pail-fed calves to thrive as well as their udder-fed companions. Exposure of milk to air is aggravated in the cooling process of present dairy practice, where it is flowed openly in a thin sheet over chilled pipes.

In the new process the milk is drawn from the udder by a vacuum milker operating at one half an atmospheric pressure. It is carried to a Pyrex tank, still under partial vacuum, and thence through the bottle-filling valve, invented by Mr. Lee, directly to the bottles. A mixture of nitrogen and carbon dioxide is added to bring it up to atmospheric pressure and exclude oxygen, and the bottles are capped. Only after filling and capping are the bottles cooled.

Patents on the new valve and filling process are assigned to William R. Kenan, Jr., owner of the Randleigh dairy farm near Lockport, N. Y., where research looking to the improvement of the nutritive value of milk is being conducted.

ITEMS

BLISTER rust, deadly enemy of pine trees, is loose in central California now, the U. S. Forest Service has discovered. This fungus pest appeared in the East some years ago, worked its way across the continent by way of Canada, and has been spreading among the forests of the Pacific Coast region.

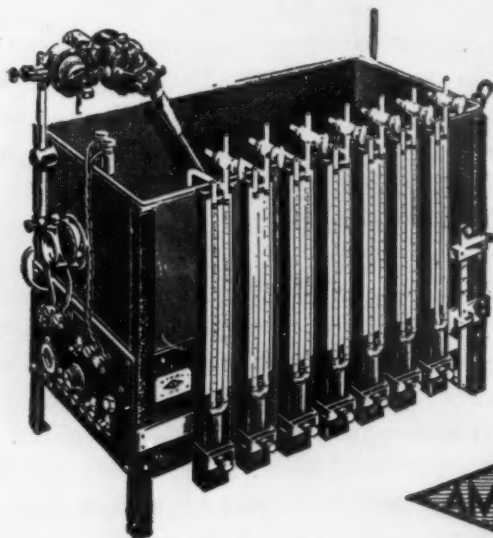
DR. ALBERT M. SNELL, of the Mayo Clinic, Rochester, Minn., reported at the Duke University medical symposium that sprue, emaciating disease of the tropics that usually starts with a very sore mouth and frequently ends in death, has its counterpart in non-tropical regions. A large number of cases which seem to be closely allied to if not identical with tropical sprue have been reported from the temperate zones. Among the symptoms of the temperate zone ailment are marked emaciation, anemia, spotted or pigmented skin, tetany (painful muscle spasms) and softening of the bones. The last two conditions, tetany and bone softening, which indicate lack of calcium, or lime, and lack of vitamins, are the chief points of difference between tropical and non-tropical sprue.

DR. GEORGE W. MCCOY, former director of the U. S. National Institute of Health and now professor of preventive medicine and public health at Louisiana State University School of Medicine, at the Duke University medical symposium reported that leprosy can not spread at present in the northern states of this country. The most important factor in attempts to control leprosy as an epidemic disease is this inability of leprosy to spread in our own northern states and in certain other localities contrasted with its fairly easy spread in other parts of the world, including states bordering on the Gulf of Mexico. The cause of the disease has not yet been satisfactorily settled, although there are many theories, including germs and improper diet.

DELICATE quick-frozen strawberries, that rival the fresh fruit in their taste and texture when defrosted and served, are now being preserved by chilling them in cold sugar syrup. In a report to the Food Preservation Conference, sponsored by the University of Tennessee and the American Society of Refrigerating Engineers, R. Brooks Taylor, of the Engineering Experiment Station, described the improved freezing process. Merit of the method is that the individual fruit is frozen at a temperature a little above zero degrees Fahrenheit instead of at severe temperatures used in some other methods. The freezing agent is sugar solution kept cold by cooling coils in the freezing container. Over 100,000 pounds of fruit have now been frozen with excellent results. Only six minutes is required for the treatment.

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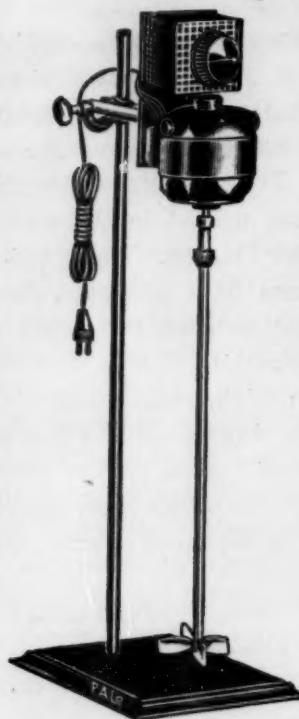
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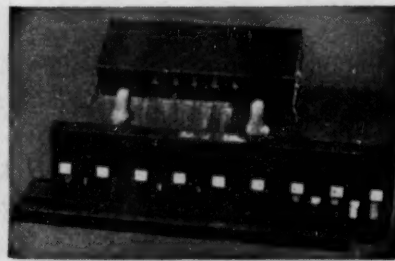
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SCIENCE NEWS

Science Service, Washington, D. C.

THE CALIFORNIA REFERENDUM ON THE LIMITATION OF MEDICAL RESEARCH

THE lives of millions of men, women and children now and in the years to come? Or the lives of a few dogs and other animals? Which will you save? This question, along with the "funny money" \$30 every Thursday plan and over a score of other referendum propositions, will come before California voters on November 8.

The proposed antivivisection legislation, masquerading as a "humane pound law," would plunge a knife into scientific research in California universities, laboratories and other institutions. It would throttle medical inquiries into the causes and cures of disease.

It is quite possible that those who vote for this restrictive legislation will be signing their own death warrants. For in California, as in other parts of the world, bands of scientists are working valiantly to conquer diseases not yet controllable or fully understood. They must have animals upon which to experiment, just as others before them have with the help of animals discovered the way to cure, control and prevent so many ills of mankind.

Loving his "man's most faithful companion," the misled or misinformed California voter for the proposed "regulation of pounds" act may very well be endangering the health of his dog. For veterinarians use scientific medicine in keeping well or curing pets and other animals.

Repeatedly in recent years the scientists, who have little enough time as it is for their investigations, have been forced to come out of their laboratories to fight for the right to continue the sort of animal experimentation that made possible modern surgery and the control of such diseases as diphtheria, smallpox, syphilis, diabetes and other ills that once raged unchecked. Emotional ladies, with the help of well-paid publicity experts, insistently plague legislative bodies with demands for what they call "antivivisection" legislation. Despite long campaigns they have been generally unsuccessful.

The California "humane pound" act represents a change of tactics. An attempt to mislead the public into approving antivivisection referendum legislation through an indirect attack is being made. The proposed act upon casual reading may appear to be innocuous, but lawyers find jokers in it. Any one collecting animals for any purpose except for sale as pets becomes a "pound-master" and any such person would be prevented from allowing any domestic animal to be used for experimental purposes. Animals for experimental or demonstration purposes would have to be bred *en masse* on the very premises of medical institutions. As this is quite impracticable, the effect would be to prevent animal experimentation on any useful scale. Moreover, such a law would open the way for persecution of medical institutions and scientists through a constant inquisition by the antivivisectionists.

Nation-wide opposition to the proposed California legislation has developed in lay, scientific and medical circles. Leading churchmen, scientists and others are advising

the California electorate to defeat this referendum proposal as they did a similar attempt in 1922. In California the California Society for the Promotion of Medical Research in opposing the measure has the backing of foremost educators, professional and lay men and women, as well as scores of scientific societies.

The mis-named "humane pound" act is called by its opponents "an intelligence test for the people of California." The antivivisectionists weigh stray dogs against babies, it is charged, and if the measure becomes law, the babies will lose. One slogan of the scientists is: "If you do not kill this measure, it may kill you!"

—WATSON DAVIS.

THE CHEMICAL INDUSTRIES OF CZECHOSLOVAKIA

THE German Reich has received the major part of Czechoslovakia's chemical industry, as a result of recent territorial shifts, according to the German correspondent of *Industrial and Engineering Chemistry*.

Control of the Sudeten area, it is shown, gives Germany a region which is highly industrial and—before the World War—was the most densely industrially populated area of all Europe. The chief plant of Czechoslovakia's major chemical combine is already under German control. This organization, Verein für Chemische und Metallurgische Produktion, produced more than 60 per cent. of the Czechs's chemical values in 1937. The historic radium mines at St. Joachimstal, from which the Curies received the ore out of which they isolated and discovered radium, is another prize.

While the chemical plants which Germany will now control are in good shape, many of the industries which are secondary consumers of chemicals are rather run down. These factories, originally built in the last century, are located in long strings in the narrow valleys which penetrate into the Sudeten mountain range. In those early days they utilized the water power of swift-flowing mountain streams.

While these plants have a difficult transportation problem, the situation is balanced, somewhat, by the presence of highly skilled labor, trained for generations in the making of precision instruments, laces, textiles and glass-blowing.

While acquiring control of Czech chemical plants, the gain raises problems for the German Reich to solve. Last year Czechoslovakia imported 47 per cent. of its chemicals from Germany as contrasted with only 8 per cent. from the United States. Czechoslovakia's chemical exports to Germany were only one tenth of the imports from Germany. Thus the two industries supplement each other, to some degree. However, many of the old Czech chemical plants will need extensive modernization if they are to compete with the great German chemical plants without their former protection of a tariff wall.

Not to be overlooked is the fact that many of the Czech chemical companies have interests in Yugoslavia,

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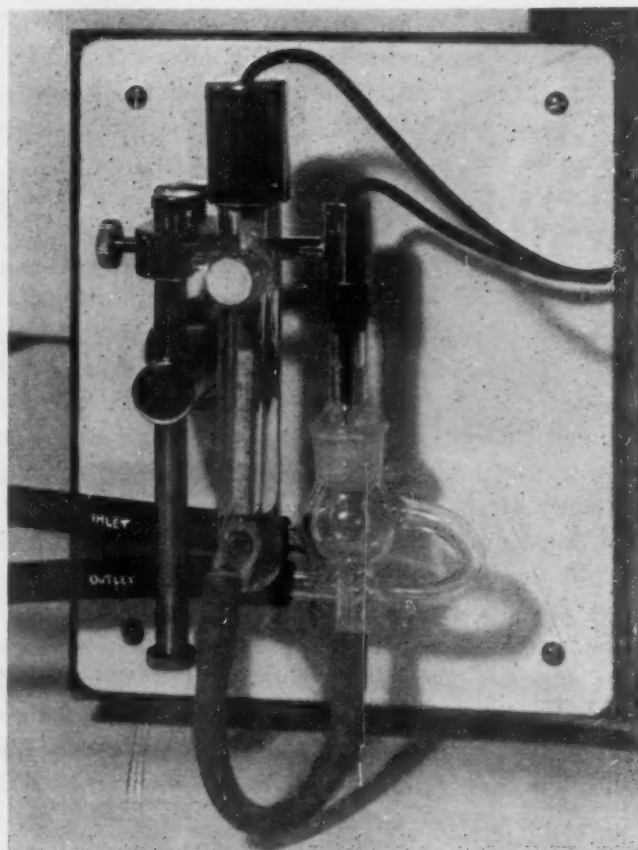
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HOW THE HEART LIVES

At the Conference on Electrophoresis of the New York Academy of Sciences, on October 28, new, fundamental knowledge of how heart tissue eats its food, grows and creates energy to keep on pumping was described by Dr. Kurt G. Stern, of the Yale Laboratory of Physiological Chemistry. With the aid of a new type of Swedish apparatus, Dr. Stern, with Drs. M. K. Horwitt and G. J. Scheff, has been tracking down the secrets of how enzymes in heart muscles control respiration and burn up food to go on living.

By chemical extraction the Yale researchers have obtained solutions from heart muscle which have potent biological activity on respiration. Formerly thought to be a mixture of insoluble enzymes and muscle tissue, these solutions have now been shown to consist of super-giant protein particles of uniform size. Some of them have a molecular weight of over 100,000,000, by far the largest molecular particle yet isolated by science. Air-driven ultracentrifuges were employed in the isolation and in the study of the size of these molecules. In some of their physical properties they resemble the virus proteins isolated by Stanley and Wyckoff, although the respiratory particles are larger.

Not only are the particles huge but they carry on their surface, suggests Dr. Stern, a fabric of colored, active groups knitted together in such a fashion that the path of oxygen and hydrogen in the combustion of foodstuffs in the cell is rigidly determined by the manner in which these surface groups are arranged. The active groups may be studied with a spectroscope. Thus, in effect, the way muscle tissue eats its food is probably along certain atomic paths, or streets, on the surface of the respiration-controlling particles.

One kind of apparatus used in this work acts like a sorting machine for the separation of heavy molecules in solution. It is sometimes impossible to separate such solutions by whirling them in a centrifuge. Invented by Professor A. Tiselius, of the University of Upsala, Sweden, the apparatus takes advantage of the different electrical charges which protein particles possess to effect the separation. By placing a solution of such particles between electrodes and applying an electrical voltage a migration of the particles begins, those with the greatest charge moving the faster.

INSECT DAMAGE TO TREES AS CONSEQUENCE OF THE NEW ENGLAND HURRICANE

NEW ENGLAND'S great hurricane will still be doing major damage next summer and for many seasons to come, warned Drs. E. P. Felt and S. W. Bromley, of the Bartlett Tree Research Laboratories, in a paper presented before the fifteenth Conference of Entomologists meeting in New Haven.

By weakening trees and exposing many new points of invasion, the storm has made them more susceptible to insect attack, it was pointed out. Of particular importance is the possibility of further spread of the Dutch

elm disease, the fungus of which is carried by the European elm bark beetle. Dr. Felt stressed the necessity for burning all broken elm branches, or at least their bark, before the end of March.

Breakage in branches, and especially in roots, has weakened trees of many species, so that such insects as chestnut borer, bronze birch borer, long-horned borers and flat-headed borers will have things made much easier for them. Near the coast, salt spray damaged pine foliage, which will be dead next year, and the weakened trees will fall easy victims to trunk and root weevils.

Another source of damage is expected in cities, where considerable parts of the street elm populations were broken down. The survivors will be subjected to the concentrated attacks of hordes of elm leaf beetles, robbed by the wind of their once numerous sources of food.

That these forebodings are more than theory is witnessed by the fact that when a hurricane sweeps over forests in the South, it is followed by a flare-up of insect damage.

HEAT AND HUMIDITY IN FACTORY CONDITIONS

IN special "hot rooms" in a laboratory at the U. S. Bureau of Mines at Pittsburgh, scientists are finding out the facts about the crucial "danger zone" of temperature and humidity where workers in industry are at the border line of heat stroke and prostration.

Under direction of the research committee of the American Society of Heating and Ventilating Engineers, studies are disclosing that injuries to health begin to occur when work is carried out at a temperature of 90.5 degrees Fahrenheit and a humidity of 90 per cent.

The tremendous toll which heat and humidity take among factory workers, especially in the South during the summer, should be lessened by the findings of the engineers' laboratory. No exact financial determination has ever been made of the economic loss involved but estimates place it at hundreds of millions of dollars annually in lost time and impaired efficiency.

At the critical condition of 90.5 degrees Fahrenheit and 90 per cent. humidity, it has been found that a worker's pulse rate accelerates 15 beats per hour of exposure. The body temperature rises at the rate of nearly a degree per hour and the body loses weight at the rate of two pounds per hour. The blood count shows the presence of 50 per cent. more white blood corpuscles. These findings are for light exercise. For heavy labor the "break down" point would be reached much sooner.

The experimental data obtained in the study will form the basis for a better understanding of industrial air-conditioning problems in certain industries and aid in the establishment of codes and practices governing a more intelligent regulation of working conditions in the interests of management and labor alike.

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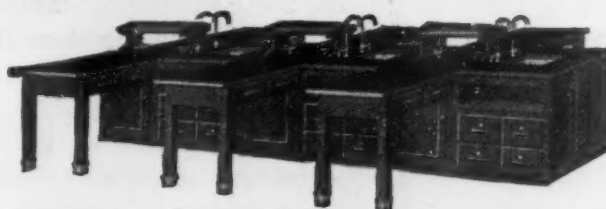


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The new fiber, claimed to be one of the greatest achievements of industrial research, is expected to be the rival of natural silk in its last remaining stronghold of usefulness—the hosiery trade. Nylon is the new material from which the new fiber is made. It is basically different from familiar rayon in that it does not require cellulose for its production.

The new fiber is the work of many chemists, but patents for its production are in the name of the late Dr. W. H. Carothers, du Pont chemist. Basic Carothers patent is No. 2,130,948 with 56 broad claims which disclose eight specific ways of creating the fibers.

Chemically the nylon fibers are polyamides. Like natural silk they have a protein-like structure. Filaments finer than silk or rayon can be spun. The filaments have amazing elastic recovery and great strength. These properties, plus the ability of the fibers to take common dyes easily, forecast the chemists' goal of making sheer, two-thread hosiery with the wearing characteristics of the four-thread, service-weight variety.

But hosiery is not the only application of the new nylon fiber. Because its diameter can be controlled at will it can be produced for a variety of products like brush bristles, racquet strings, fishing lines, woven dress goods, velvets, knitted and woven underwear. It can also be employed as a transparent wrapping film, for plastic compositions, textile finishing agents and coated fabrics. Toothbrushes with the synthetic bristles are already on the market.

Construction of an \$8,000,000 plant at Seaford, Del., for the production of the fiber will start in December. Production from this plant will probably start in about a year.

ITEMS

A MASTODON, whose skeleton includes both the largest and smallest mastodon bones ever found, was placed on view on October 28 at the official opening of the new Hall of Geology and Paleontology and the Bennett Alcove of Geology in the Hall of the Niagara Frontier of the Buffalo Science Museum. Containing the 12½ foot tusk, the largest mastodon bone, and an eight and a half inch hyoid bone, the smallest, the group shows the excavation where the skeleton, which dates back only to 1500 B.C., was found in 1930. Not quite so large as a circus elephant, the mastodon nevertheless had bigger tusks and like the elephant, a tough hide. Its hide, however, was covered with a heavy coat of hair.

A SOLAR heater, which absorbs heat from the sun's radiation and puts it to use for cooking and similar purposes has been patented by Dr. C. G. Abbot, secretary of the Smithsonian Institution. The sun's rays are caught by the apparatus, which uses the sun's energy to heat oil. The oil in its turn heats an oven, a boiler or whatever device desired. Dr. Abbot's invention is covered by Patent No. 2,133,649. He has been active in research seeking to utilize the sun as a source of power for many years.

THE DC-4, world's largest landplane, which has just completed its manufacturer's trials, is back at the fac-

tory. But nothing's wrong with it—workmen are only taking out four and a half tons of test equipment and putting in fittings that will make it fit for the most discriminating passenger. Seats and berths that will make space for forty-two passengers by day and thirty-two by night as well as knick knacks that go with the accommodations are being installed. So is soundproofing; engineers don't mind the noise, but the passengers do. Among the items listed in the huge craft's equipment is a curling iron in the ladies' dressing room. The plane has been built to the order of America's five leading airlines. It will go to them in turn for 60 days of trials before production of regular models begins.

WHEN you get angry or experience some other emotion, it shows up in your brain waves, the record of electrical activity in the brain, according to a report by Dr. Hudson Hoagland, of Clark University, to the Academy of Physical Medicine. Brain waves from normal persons do not show as much variation under emotional stimulus as brain waves of mentally sick patients. The studies suggest the emotion does not originate in the cortex of the brain.

ANIMALS that live in the sea are not always free to swim the sea whithersoever they will. Submarine heights and depths, wide stretches of inhospitable water, may be as great barriers to sea life as mountains, canyons and deserts are to life on land. But sea creatures unable to make far journeys under their own power may "get there just the same" by clinging to drifting trees, logs and other chance-made rafts, according to Dr. Paul Bartsch, of the U. S. National Museum. His results are described in a new publication on the marine mollusks of Hawaii, written jointly with Drs. William H. Dall and H. A. Rehder, also of the National Museum staff, and published by the Bishop Museum of Honolulu. Dr. Bartsch is convinced that Hawaii's sub-shore mollusks reached the island by such drifting voyages.

THE rushing streams of Great Smoky Mountains National Park will soon have quiet pools introduced into their courses, here and there, by colonies of beaver which the U. S. National Park Service plans to introduce. Although the animals themselves will be strictly protected against hunters, they are expected to be of indirect benefit to fishermen, because their ponds provide shelter and grow food for fish. Beaver were abundant in the Great Smokies region many years ago, but early settlers trapped them all out, as they did in many other parts of the country. Where beaver receive reasonable protection they multiply rapidly. Their dams have come to be recognized as material aids in the fight against soil erosion.

WITHOUT even waiting for the much-discussed mechanical picker, cotton raising is becoming mechanized, a study conducted by the Works Progress Administration discloses. Tractors, feasible in fields on level or gently rolling terrain, are doing the trick. In the thirty-year period from 1907 to 1936 the labor requirements of cotton production declined by 16 per cent. per acre and 20 per cent. per bale. The greatest declines in labor costs were noted in the western cotton-producing areas, from the Mississippi Delta on out to southern California.

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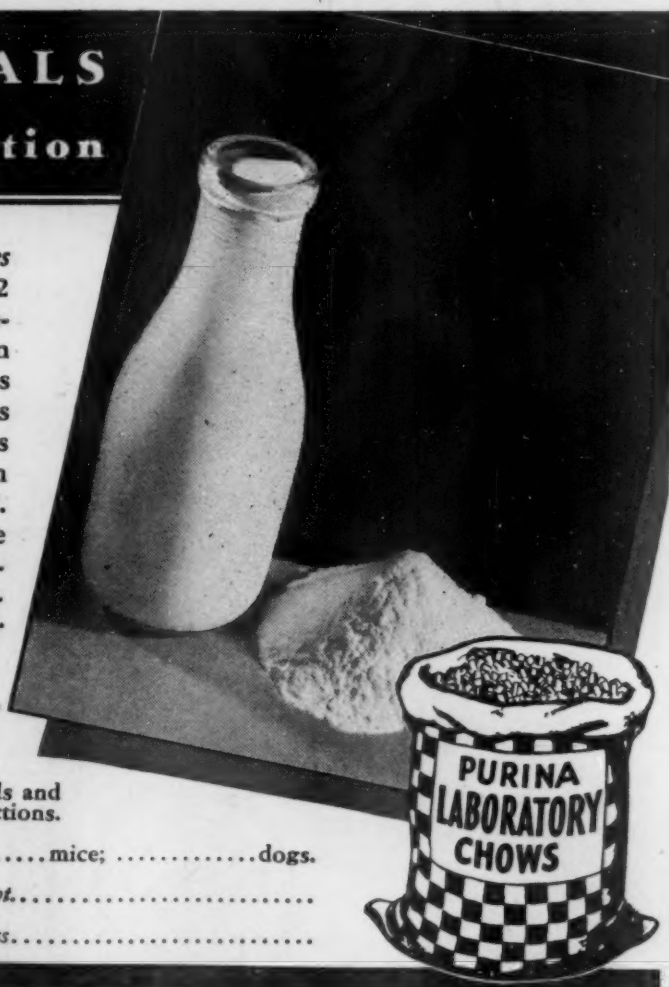
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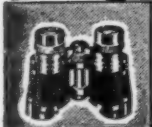
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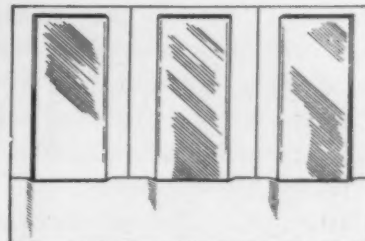
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SCIENCE NEWS

Science Service, Washington, D. C.

THE BASIC CONSTANT OF ATOMIC PHYSICS

DEEP down in a tiny, sub-basement laboratory at the Johns Hopkins University a large diamond slab—that would cost you \$4,000 on the open market—is being used to probe the fundamental constants of the physical world.

Did you ever hold a flawless \$4,000 diamond in your hand knowing that if you dropped it to the floor it might chip or shatter? Probably not. But you can realize that you don't hold it, you clutch it.

And yet clutching is difficult, for the Johns Hopkins diamond has a slippery surface because it is ground smoother than ever a diamond has been ground. One surface is plane to within a tenth of the length of a green ray of light; or about one five-hundred-thousandth of an inch.

"Here it is," said young Professor J. A. Bearden, Hopkins's x-ray expert, as he handed me a test-tube filled with a brownish fluid. And there, floating in the fluid, was a shimmering three-carat diamond slab as big as the nail on a man's little finger. Yes, the diamond was floating. "You see," explained Professor Bearden, "we have to know the density of this diamond. One way to determine the density is to make up a special solution just as dense as the diamond so that it will neither float nor rise in the tube. So delicate is the balance that if I place my hand on the test-tube, and warm the solution slightly, the diamond starts to sink. The heat of my hand expands the liquid, makes it less dense and so the diamond starts to sink because it is relatively more dense. If I want to make the diamond rise again I reverse the process, immerse the liquid in cold water, make the liquid more dense so that the diamond becomes, relatively, lighter than the liquid and rises."

Using a little hook, Professor Bearden snared the diamond and lifted it out of its brownish bath, washed it out and put it in my hand. Its surface seemed slippery because of its smoothness. Gingerly I held it up and saw the brilliant gleaming colors of refraction in the flawless gem. And then quickly I laid it down on a convenient black cloth.

One corner of the diamond is used as a tiny prism to bend, or refract, x-rays. By knowing the amount of refraction of the x-rays—and a lot of other details too—Professor Bearden is able to calculate the value of the very important physical constant known as "e over m": "e" stands for the charge on the electron and "m" for the mass of the electron. As the physicists write it, "e/m", appears again and again in the equations of atomic physics. So important is the constant that scientists are ever searching for different ways of determining its value. In fact they seek to check measures made by one method against those made by another to get the most exact determination possible. Professor Bearden uses the x-ray refraction method to provide a new and more accurate determination. His scientific report, describing his discoveries, appears in the current issue of *The Physical Review*.—ROBERT D. POTTER.

HYDROGEN AND THE SUN'S HEAT

THE end of the world will come when the amount of hydrogen in the sun becomes only a few per cent. less than it is now, according to a statement made by Dr. George Gamow, professor of theoretical physics, in a lecture at George Washington University. But it will be difficult to observe any climatic changes for a long time due to the gradual increase in the sun's heat.

Yet, despite this present comforting picture, the sun is bound eventually to become 100 times brighter than it is now, when the hydrogen content falls only slightly. "Such a brightening of the sun," declared Professor Gamow, "will necessarily lead to the melting of the earth and, of course, the disappearance of life."

In his lecture on "The Evolution of Stars," Professor Gamow showed that transmutation of the elements—and particularly the transformation of hydrogen into helium—accounts for the enormous amount of radiant energy liberated by the stars and our sun. Temperatures of several millions of degrees are attained inside stars.

The rate of the reactions of atomic nuclei, leading to the energy production, depends essentially on the mass of the star. Very heavy stars, with masses several hundred times as great as the sun must be very bright and hot. They are known as "blue giants" to astronomers. Stars of very small mass are faint and reddish in color and are called "red dwarfs."

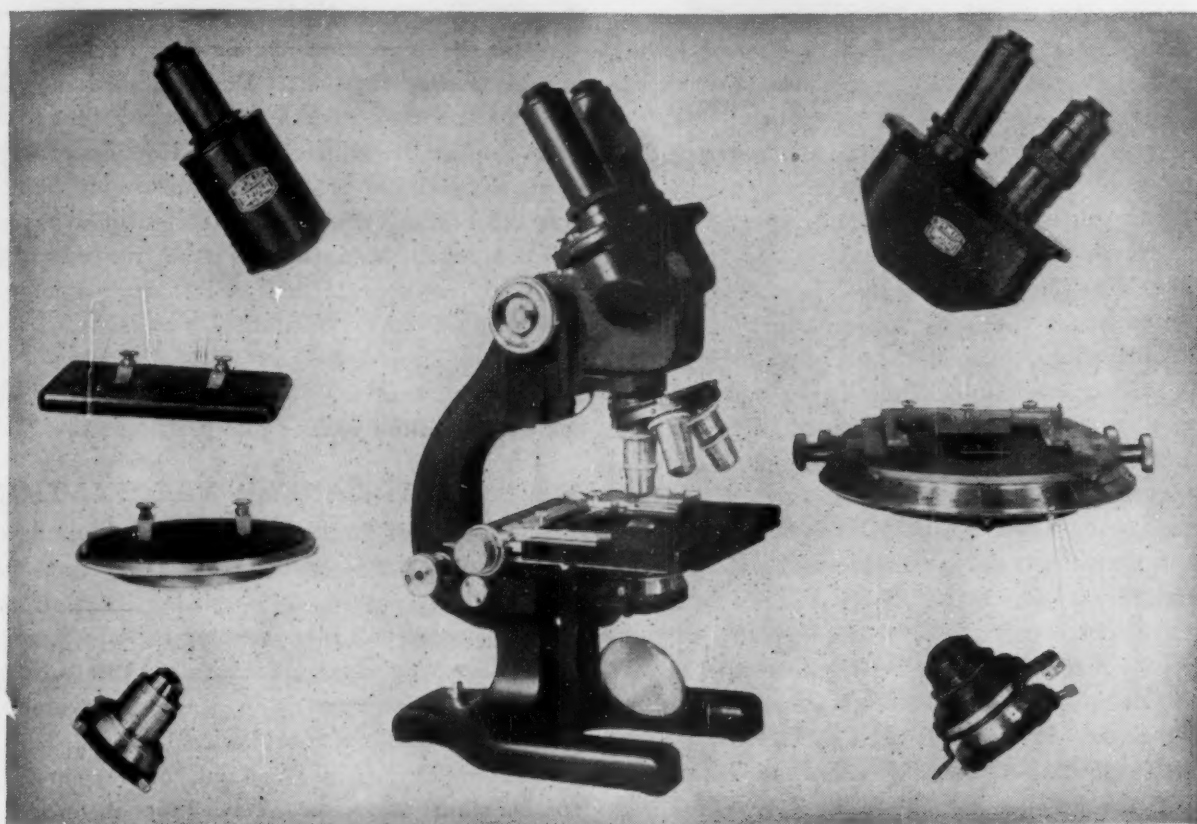
The eventual density of our sun, after it has long since melted the earth, is gradually to become an absolutely dark and cold body of very high density. This will occur after the sun passes through a period of maximum brilliance which it is now, very slowly, approaching.

THE PRINCIPLE OF THE ECHO ALTIMETER

THE single most important contribution of the year 1938 to safer flight—the absolute altimeter, which shows height above the ground rather than height above sea-level and thus warns a pilot of obstacles—kicked around inside the heads of scientists and engineers for years because radio equipment that could make it work did not exist.

The patent, No. 2,045,072, covering the absolute altimeter which, if it works as it gives promise of, will do more for safe flying than any other single development under way, was granted to Lloyd Espenseheid, of Kew Gardens, Long Island, N. Y., on June 23, 1936. But the original application for a patent to protect the idea on which it is based was made more than eight years ago, on April 29, 1930. The patent was assigned to the American Telephone and Telegraph Company.

Actual development work on the device did not begin until January, 1937, when Peter C. Sandretto, communications engineer of the United Air Lines, approached the telephone company to ask for their cooperation in the development of a method to warn their pilots of approaching obstacles. Had the airlines had such a device, a survey of accidents during the last few years shows, more than half the disasters that have marred the record of



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American aviation would not have occurred. The reason for the delay—between 1930 and 1937—lies in the fact that the new altimeter uses ultra high frequency radio waves. Transmitting equipment from these very short radio waves has been developed only recently.

A 500-megacycle radio wave is transmitted from a small T-shaped antenna on the underside of the right wing. On this wave is impressed an 80-cycle audio frequency wave. This combined wave is sent earthward and is reflected by the earth back to the plane, where it is picked up by a similar antenna under the left wing. A portion of the transmitter's output goes directly to the receiving antenna. The device essentially counts the number of 80-cycle beats occurring between the time the direct wave is received and the time the reflected wave is received. The 80-cycle audio frequency wave is impressed on the 500-megacycle carrier wave because the former is easier to count—the apparatus is much simpler. The ultra high frequency carrier waveband is used because it is free from static, can be directed more easily and because of its limited range. A recessed housing for the antennas, to cut down wind resistance, will be possible on new planes, but not on existing craft. Its use on existing craft will entail a slight loss of speed, but, on the other hand, a much greater gain in safety.

Accidents that would have been prevented, had such a device been available, include the disaster to the *Lockheed 14*, which crashed into a mountain near Los Angeles this year; the two planes lost in recent years near Saugus Gap, near Los Angeles; the T.W.A. plane lost near Fresno; the planes that have been lost in Wyoming and Utah, as well as others.

Further testing is necessary. In addition to that Western Electric engineers, who are in charge of the development, will require about five months to get set for making the equipment. A year in all will be necessary before airliners on regular scheduled runs can use the device.

Working with Mr. Sandretto on the device has been Russell Newhouse, of the Western Electric.—LEONARD H. ENGEL.

CULTURE OF MEN OF THE STONE AGE

STONE AGE men all the way from China to India and south to Java had the same general type of culture and used much the same kind of tools, it is indicated by results of the American Southeast Asiatic Expedition, published in the *Proceedings* of the National Academy of Sciences by its field director, Dr. Hellmut de Terra.

The expedition has concluded its exploratory work in Burma, which seems to be a connecting bridge uniting the three corners of this great triangle of ancient culture. As reported by one of Dr. de Terra's colleagues, Dr. Hallam L. Movius, it is not yet certain whether the civilization they studied originated in China and spread westward and southward, or whether it started farther south and made a three-direction spread.

The stone tools used by these ancient peoples are of the crudest type of workmanship. They included choppers, scrapers and (except in India) fist axes. In Burma, a favorite material was petrified wood. Associated with

the human artifacts were bones of elephant, rhinoceros, hippopotamus, buffalo, horse and deer.

After the expedition had finished its work in India, the members, who included Dr. Teilhard de Chardin in addition to Drs. de Terra and Movius, went to Java where they visited Dr. G. H. R. von Koenigswald, who is investigating the sites of *Pithecanthropus* finds under the auspices of the Carnegie Institution of Washington.

The third *Pithecanthropus* skull, recently discovered by Dr. von Koenigswald, has at last set a geologic date for this ancient race. Hitherto not definitely dated, the Java Ape-Man has now had his time set as mid-Pleistocene, that is, about the middle of the Ice Age, some half-million years ago.

ANTI-CANCER VACCINATION

THE dream of finding a way to vaccinate against cancer is one step closer to becoming a reality or to being finally and definitely proved to be nothing but a dream. Which way the dream will turn out may be determined by studies now under way at the Rockefeller Institute for Medical Research. The first step toward making anti-cancer vaccination either a glorious reality or a lost hope is reported by Dr. John G. Kidd, of the institute, in the forthcoming issue of *The Journal of Experimental Medicine*.

One kind of cancers or tumors, the papillomas of rabbits, are known to be due to a germ of the virus type. This germ or virus, Dr. Kidd has now found, is strikingly similar, in its ability to induce resistance or immunity to itself, to other germs against which vaccination is successful. It acts like the classical antigens of other disease germs which call up the germ-fighters of the body known as antibodies. It is because of such antigens that vaccination or immunization against smallpox, diphtheria and a few other diseases is possible.

Discovery of such an antigen substance in rabbit papillomas means that it should be possible to protect rabbits from these tumors by a sort of vaccination. Whether the same can be done for other kinds of tumors, including human cancer, depends on whether such antigen substances in the tumors can be found. Search in this direction, Dr. Kidd reports, is now being made. The results should provide the final word on the possibility of anti-cancer vaccination.

TRIMETHYLAMINE

A WIDELY found organic compound known to chemists as trimethylamine, present in many plants and animals, has been shown by Professor Laszlo Havas, of the University of Brussels, to have physiological action like that of a sex hormone. Professor Havas has reported his experiments in *Nature*.

The chemical is highly active, producing marked results in dilutions as weak as one part in 25,000, or even one part in 60,000. Injected into the stems of young tomato plants, half an ounce or so of the solution produced an increase by 22 per cent. in the number of flowers. Frogs placed in a trimethylamine solution moulted their skins and prepared for mating activities, even though the mating season was three months past. Other amphibians

similarly treated also showed signs of having their mating instincts roused.

The substance is somewhat poisonous, however, and the treatment had to be discontinued after a few days lest the animals be harmed. The solution also stimulated the growth of plant tumors in tomato stems that were first inoculated with the bacteria that cause plant cancers, and then treated with the 1:60,000 concentration.

FOLSOM MAN

UNEARTHING a mammoth tusk at the now-famous summer camp of America's Folsom Men in Colorado, Dr. Frank H. H. Roberts, Jr., of the Smithsonian Institution, has the first evidence that shaggy elephants were hunted around this prehistoric camp ground.

According to Dr. Roberts, these elephants were alive during the closing days of the last Ice Age, at least 10,000 years ago. The extent of their camp, and quantities of stone implements and debris of meals, tell of hunters who returned year after year. Their game is identified as herds of bison, musk-ox and camel that browsed in pastures where streams flowed from the melting glaciers.

New discoveries this summer include several new kinds of knives and scraping tools, all unmistakably like the workmanship of America's other Folsom Age hunters. Many of the hunters' crude attempts at art have been unearthed, indicating that in this early era American art was merely geometric lines scratched on bone.

Although Dr. Roberts has sought tirelessly for bones of the hunters themselves, the Folsom Men in Colorado and elsewhere in America continue to be ghostlike figures known only by their trail of characteristic weapons and tools and the bones of animals they killed.

Dr. Roberts also investigated two reported sites of Folsom Man in Wyoming and in Canada, finding typical Folsom weapons as far north as Saskatchewan. Tracing the hunters into the north country may eventually clear up the question as to when America was first inhabited, that is, whether man arrived early in the last Ice Age, before glaciers closed the available corridors from the north, or whether they waited until the ice melted enough to provide a route where game and plant life existed. According to another theory, a corridor east of the Rockies remained ice-free, affording passage into America at any time during the last Ice Age.

ITEMS

A LIFE-SIZED figure of a normal woman, made out of translucent material, will show visitors to the New York World's Fair next summer how cancer spreads from the first small lump on a woman's breast to other parts of the body, unless that dangerous first lump is promptly removed. The "Cancer Woman," designed by and constructed under the direction of John L. Broomfield, of the New York Museum of Science and Industry, will be given a public pre-viewing at the museum during November and December. The woman's figure is part of the special cancer exhibit which has been prepared for the Fair under the direction of Dr. Francis Carter Wood,

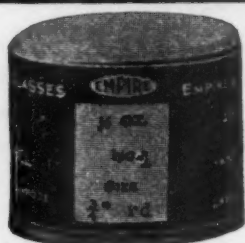
of the Institute of Cancer Research of Columbia University.

A WHITE bison bull, an animal rarer than the sacred white elephant of Siam, is an inmate of the National Zoological Park at Washington. It was born on the National Bison Range near Moiese, Mont., and was presented to the park by the U. S. Biological Survey. White bison were great rarities even in the days of the vast herds on the western plains, a couple of generations ago. The Indians considered them sacred. One plains tribe, the Atsina, used to kill large numbers of bison by driving them over cliffs. But if they found one white animal in the mass thus slaughtered wholesale, only the direst necessity could drive them to take the meat or hides of any part of the whole herd.

THE National Bureau of Standards and the American Dental Association have been working together for a score of years to provide American sufferers from dental decay with more enduring teeth. A list of dental repairing products that have been checked by the bureau in cooperation with the dental association is to be published in the association's journal for the month of November. Dental cements, amalgams, gold alloys, tooth-matching filling cements and accessory materials will be listed by name in the journal, following tests designed to show how well they stand up and what the patient gets for his money. As with the American Medical Association in the case of remedies and instruments, members of the dental association are expected not to use products which are condemned. The list represents twenty years of research at the bureau. Funds of the American Dental Association have been used since 1928 to support the study, which is being carried on continually to check old products and test new ones.

AMERICAN consumption of tin, a strategic material which must be imported and most of which comes in fact from the Malay States, rose by nearly 7,000 long tons during 1937, according to the U. S. Bureau of Mines. Tin consumption amounted to 90,137 tons of both primary and secondary tin during 1937 as against 83,050 tons in 1936. Four fifths of this was virgin tin, the consumption of which also increased. The world's main source of supply, in the Malay States, is now under British domination, but is within striking distance of the expanding Japanese empire.

THE Palisades of the Hudson River were once huge lava beds which have withstood weathering until they now rise predominant above the surrounding terrain of the Hudson River Valley, according to Professor S. J. Shand, of Columbia University. He will lead a field trip to the Palisades during the coming meeting of the Geological Society of America in New York City. The Palisades sill, as it is known, is several hundred feet thick. It was formed about 160,000,000 years ago by a flow of lava which forced its way upward and between hardened beds of sand and clay previously laid down by ancient streams and lakes. Erosion gradually removed the overlying sand and clay and left the towering scenic cliffs.



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SCIENCE NEWS

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AWARD OF THE NOBEL PRIZE IN PHYSICS

THE Nobel prize in physics for 1938 has been awarded to Professor Enrico Fermi, of the University of Rome. Born on September 29, 1901, Professor Fermi has won fame in both experimental and theoretical fields of research. He was the first man to predict and determine experimentally that the bombardment of elements by neutrons would cause transmutation of the elements. Working at Rome, Professor Fermi was able, within six months after the discovery of artificial radioactivity by the Curie-Joliot, to study the bombardment of over 60 elements with neutrons. Out of this number he found more than 40 to exhibit radioactivity.

Professor Fermi was also the first to show that the capture of neutrons could be facilitated by water and by making them travel at low speeds. These "slow" neutrons are now a valuable research tool in the field of nuclear physics. In theoretical physics he is best known for his development of the so-called Fermi-Dirac statistics, a mathematical method of dealing with the problems encountered in predicting atomic structure and behavior. In mathematical physics, he developed a hypothesis known as the Fermi theory of beta-ray decay which attempted to fit the atomic particle, the neutrino, into the still baffling problem of the liberation of the beta rays (electrons) from radioactive materials. While this theory is far from correct it is still the only one, of the many suggested, which appears to have a semblance of plausibility.

During his intensive research on the bombardment of many elements with neutrons Professor Fermi used uranium as a target. He was able to make the neutrons stick in the nuclei of the uranium atoms and create super-heavy elements. At first the scientific world was amazed and skeptical that Professor Fermi had been able to create an element, No. 93, heavier than the heaviest of all known elements, uranium, No. 92. However, the discovery was amply confirmed and it has since been found that science can create artificially elements still heavier, Nos. 94 and 95.

Through his atomic experiments Professor Fermi was able to show that the ability of the nuclei of atoms to capture neutrons was far larger than had been supposed. There appear to be conditions of resonance in the nucleus which aid in this unsuspected capture.

Coworkers with Professor Fermi at Rome have been a group of scientific men whose names should not be forgotten. They are Drs. E. Amaldi, F. Rasetti, E. Segré and B. Pontecorvo.

AUTOMATIC POSITION FINDER FOR AIRPLANES

AN experimental model of a position finder which automatically tells an airplane pilot where he is at a given moment, with only a small error, has been successfully demonstrated at Hamble, England.

The device, still very much in the process of development, consists of a pair of automatic direction finders,

each tuned to a different radio station. Each is linked to a needle swinging on a point representing the station to which it is tuned; hence each needle points toward the plane. The point where the needles cross is the point where the plane is located. The two needles are, of course, located on a map of the region over which the plane is traveling.

Successful development of this device will mark another of the major safety advances in aviation that seem promised by instruments demonstrated within the last few weeks. Not only would it be another insurance against being lost, but it would be useful in medium-sized transport and military planes which can not carry a separate navigator and whose pilots already have more than enough to do. Collaborating in the development are O. G. E. Roberts, of the Straight Corporation, and J. A. McGillivray, chief wireless instructor of Air Service Training.

An automatic direction finder, which in itself is a guarantee of not getting lost, has been independently developed and demonstrated in the United States by the Sperry Gyroscope Company and the Radio Corporation of America, both of New York.

This new scheme merely takes two automatic direction finders and operates on the well-known principle that the lines from the plane to the stations must intersect at the plane. By superimposing the lines on a map, in the form of needles that respond continuously to changes in the plane's position, the pilot can be kept informed of where he is.

Refinements in construction of the direction finders and in other parts of the equipment may mean some day that much of the laborious work of calculating one's position will be made unnecessary. It should also make ground speed determination, still one of the not-so-easy-to-figure aeronautical facts, easier to determine.

The present equipment is still subject to certain errors, one of which probably can be eliminated, and the other of which is not a large error. The possibility of linking the device with the automatic pilot is also foreseen. Reports emphasize, however, that this model is only an experimental one and that conclusions as to its performance in production models, which are still a long way off, can not yet be drawn. Its weight, now 100 pounds, can probably be reduced to 60 pounds.

USE OF THE CYCLOTRON IN THE TREATMENT OF HUMAN CANCER

HUMAN cancer sufferers are now being treated for the first time with neutron rays from the 85-ton cyclotron of the University of California.

Announcement of this use of the cyclotron, which it is hoped will greatly advance the war against cancer, was made by Dr. Ludvig Hektoen, executive director of the National Advisory Cancer Council, adjunct of the U. S. Public Health Service, which has been in the forefront in supplying funds and technical assistance for this newest assault on cancer.

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Cancer sufferers throughout the nation are warned not to start for California in the hope of getting treated by the cyclotron. The treatments are purely experimental and no successful outcome can be promised. Only a small group of patients from the teaching hospital in San Francisco of the University of California are being treated. The cyclotron's neutron rays have been so effective in treating cancerous growths on small animals that scientists believed this treatment was worth at least a trial on human cancerous growths.

"The success of the neutron ray in animal experimentation does not justify any conclusion that it will be necessarily more successful in treating human beings than x-rays," said Dr. John Lawrence, who, with Dr. Robert S. Stone, chief roentgenologist in the hospital in San Francisco, is directing the experiments. "It may be months or even years before any results are known and, until then, we can offer no additional hope to cancer sufferers."

Dr. Lawrence is the brother of Dr. E. O. Lawrence, the physicist who developed the cyclotron and the neutron ray used with cancer patients. The neutron rays are created by bombarding a target of a light metal, notably beryllium, with very energetic deuterons, which are the nuclei or ions of heavy hydrogen.

The rays produced by this method were found to have a sharply different effect on biological tissue cells than the x-ray, and it was this difference which led to the present clinical investigations.

UNRECOGNIZED HORMONE OF THE PITUITARY GLAND

AN unrecognized hormone, called "the specific metabolic principle" and produced by the middle part of the pituitary gland, has been chemically dissected from the tiny "master gland" by a group of investigators at McGill University, headed by Professor J. B. Collip. Associated with Professor Collip were Drs. D. K. O'Donovan, E. F. Denstedt, A. H. Neufeld and L. W. Billingsley.

The new hormone speeds up the rate at which the body converts food, fuel or energy. This vital process is known as metabolism. Professor Collip and his associates found that it stimulates metabolism quite independently of the thyroid gland. It does not work by first stimulating the thyroid, as does another pituitary hormone called the thyrotropic hormone. Doses of the hormone injected into rats, rabbit and guinea-pigs from which the thyroid glands had been removed increased the metabolic rate markedly within four hours.

The new hormone has other striking effects. It neutralizes to some extent the effect of insulin, diabetes remedy. Insulin ordinarily lowers the amount of sugar in the blood, but when the new hormone is given, the usual dose of insulin has a diminished effect on the blood sugar. Large doses of insulin, however, are not neutralized.

The hormone also exercises some control over the adrenal glands, judging from its effect when given with adrenalin, one product of these glands. The effect of adrenalin on blood pressure is not affected by the new hormone, but the effect on blood sugar is. The amount

of sugar in the blood goes up, instead of down, when adrenalin is given.

Professor Collip described the hormone at the Third International Goiter Conference recently held in Washington, D. C.

THE AMERICAN PATENT SYSTEM

To destroy the basic concepts of the American patent system would be to destroy the pattern of present-day industry and bring a return to secrecy of invention, Dr. Frank B. Jewett, vice-president of the American Telephone and Telegraph Company, stated in an address given at the Philadelphia meeting of the American Institute of Chemical Engineers.

Citing the protection afforded by the patent system as the backbone of industrial progress, which has made possible the enormous growth of the last century in America, Dr. Jewett urged that efforts to attack the patent system should be limited to the prevention of long-drawn-out lawsuits and toward expediting the handling of unavoidable litigation. Efforts to change the patent law of America so as to alter its basic concept of a long term monopoly as the reward for disclosing the nature of the invention were termed "eye wash" by Dr. Jewett.

Of the charge that industry deliberately suppresses socially valuable patents, he said:

"That the number of unused patents is large goes without saying. That any considerable number of them are of much, if any, value, I doubt, and that any really valuable ones are 'suppressed' I just simply do not believe. The explanation is that any one possessed of a valuable patent has every reason to exploit it before its life blood runs out and dare not delay the exploitation for fear his competitor will get a better patent. I have no doubt that there are now, as there always have been, valuable patents which are not in use because the art to which they apply is not yet far enough advanced to permit. This is not suppression—all the will in the world could not force use under the conditions."

THE RESEARCH FUNDS OF THE GOVERNMENT

RESEARCH for the American farmer and engineering research, mainly for national defense, absorb over \$43,000,000, or 75 per cent., of all the \$57,700,000 research expenditures of the Federal Government, according to an analysis, made after a study of the Federal budget for the fiscal year 1938, by Dr. Lyman J. Briggs, director of the National Bureau of Standards in Washington. Dr. Briggs's report was made to a forum at Detroit on "Invention and the Engineers' Relation to It," sponsored by the American Engineering Council.

The distribution of research funds, exclusive of statistical agencies and those engaged in social sciences is approximately as follows:

Engineering research, mainly national defense	36%—\$21,000,000
Surveys and mapping	16%— 9,400,000
Physical sciences	4%— 2,200,000
Natural sciences, mainly agricultural research	39%—22,400,000
Public health	5%— 2,700,000

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The Federal Government, Dr. Briggs explained, thus confines its research activities almost exclusively to subjects having an immediate practical interest. It has not undertaken long-range research, except in the field of agriculture. Basic research in this country has in the main been carried out by our colleges and universities. In so far as these institutions have been supported by state funds, the various states have borne the responsibility of providing for basic research, upon which new industries are built.

"New industries, which create additional employment, grow out of discoveries made in the laboratory. The radio industry is a striking example. To provide more employment we need new facts, new discoveries, upon which new industries may be based—industries that will supply things that people will want in addition to what they already have, not industries which merely compete with those already in operation.

"Discoveries of this kind are not made overnight, but they will continue to be made, as they have been made in the past, if facilities and support are provided for basic research. A steady flow of new discoveries would stabilize economic conditions. Coordinated basic research, directed along lines that may lead to new industries, should be supported by the Federal Government as long-time insurance against unemployment and economic stagnation."

ITEMS

A RING of charged atomic fragments surrounding the earth 20,000 miles above its surface during a period of high sun-spot activity was reported in a lecture at the California Institute of Technology by Professor Robert A. Millikan. Detected through measurements of cosmic rays, this ring has been built up gradually since 1932, when sun-spot activity was low, until it is now at a maximum. Sudden changes in this ring of charged particles also takes place when the sun is having a particularly violent eruption. The effect of solar activity is to cut down the magnetic field surrounding the earth and thereby to permit more cosmic rays to reach us than before. The intensity of cosmic rays thus becomes a way of measuring the magnetism of the earth, especially that part of the magnetism which is due to currents outside of the earth itself.

THE 125th anniversary of the Nikitsky Botanical Gardens in the Crimea was observed by the establishment of five new gardens, supplied with plants from the parent institution. During the past decade over 1,000 new species and varieties of plants have been tested in the gardens, and 233 new kinds were introduced into general cultivation in the USSR as a result of these tests, states *Tass*.

COLD climate is good for growing corn, declares Professor Karl W. Woodward, of the University of New Hampshire. He points proudly to the fact that the average per-acre yield in his state, 44 bushels, tops even that of Iowa, 38 bushels, and is more than double that of two typical states in the South, Louisiana and Arkansas, whose average per-acre corn yields are 18 and 19 bushels, respectively.

METHYL bromide has been successfully used to kill insects feeding inside of apples, in experiments reported to the journal, *Scientific Agriculture*, by W. R. Phillips, H. A. U. Munro and C. E. Allen, of the Canadian Department of Agriculture. The substance, while deadly to insects, leaves so little residue in the flesh of the apple that it is harmless so far as human consumption is concerned. Some of the apples were damaged by the fumigation, but it was found that this damage could be eliminated by picking the apples at the proper state of maturity and storing them at a temperature between 32 and 39 degrees Fahrenheit.

SUBMERGED canyons are not all beneath the sea. There is one, of quite respectable dimensions, drowned under the waters of the northern end of Lake Michigan, states Dr. George M. Stanley, of the University of Michigan, in the current issue of the *Journal of Geology*. Cut steeply into the more gradually sloping lake bottom, the valley winds like the channel of a river, and was without doubt formed by the action of a stream before or during the glacial age. The bottom of the channel varies from 150 feet to as much as 300 feet below the present lake level. It continues on into Lake Huron, and just beyond Mackinac Island it widens out into the deep basin of what was the ancestor of Lake Huron in the days before the Ice Age.

NEW light on the American Indians' family tree is being gained by scientific investigation of an unknown prehistoric race that once inhabited the Aleutian Islands that swing out from Alaska toward Siberia. At the Smithsonian Institution Dr. Aleš Hrdlička is studying a large collection of skulls and bones of these people, some partly mummified, which he found during expeditions to the Aleutian Islands. The new-found race is believed to be ancestral to some of the Indian tribes that occupied the Pacific coast, including California, when white men came to America. The pre-Aleuts, as these long-lost ancestors are descriptively termed, lived about 2,000 years ago. They were descended apparently from earlier immigrants who had come over from Asia to Alaska, and they were followed in turn by the Aleuts. Dr. Hrdlička's exploration in the Far North have demonstrated that Alaska was a racial cross-roads with five or six different Eskimo, Aleut and Indian peoples crossing and re-crossing one another's path. All of them contributed in some way to the blood of the tribes that peopled North and South America.

MORE and more the railroads of America are making use of "velvet track," declared H. C. Drake, of the Sperry Products, Inc., Brooklyn, N. Y. Flash welding of railroad rails into long continuous stretches of rail makes this achievement possible. In this welding method the two ends of ordinary track lengths are placed next to each other and a heavy electric current preheats them. Then they are moved in and out of contact, a few times, as extremely hot arcs of electricity flash between them. Finally the two ends are squeezed together with a pressure of 10,000 pounds to the square inch to complete the weld. "Velvet" riding smoothness, without the familiar clicking of the wheels on rail junctions, is the result.

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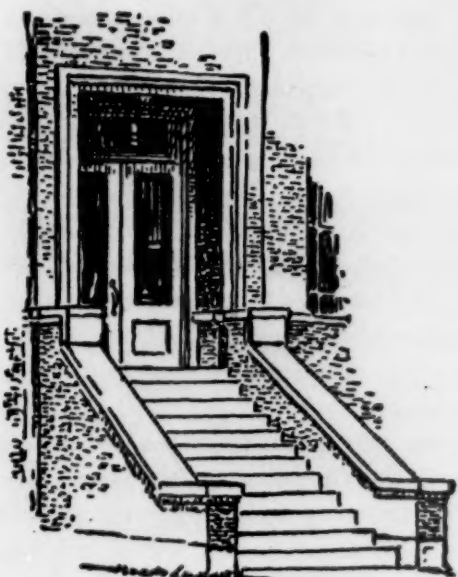
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SCIENCE NEWS

*Science Service, Washington, D. C.***BETTER HOUSING AS A PREVENTIVE OF RHEUMATIC FEVER**

REPLACING the poorer homes in the nation by proper housing facilities and eliminating other bad effects of housing were recommended, as measures for prevention of rheumatic fever, by Drs. Carroll M. Pounders and James K. Gray, of the University and Crippled Children's Hospitals in Oklahoma City, at the meeting of the Southern Medical Association.

Rheumatic heart disease, according to one estimate quoted by Drs. Pounders and Gray, makes up from 35 to 40 per cent. of all cases of heart disease among adults. It is pointed out that rheumatic fever is not just a disease of the joints. It is an infectious disease which affects various parts of the body, but shows up chiefly in the heart, the joints and surrounding structures, the nervous system and tissues just under the skin. When the nervous system is affected, the condition is termed chorea or St. Vitus' Dance. "It is predominantly a disease of school age," Drs. Pounders and Gray stated, "and flourishes among the poor where there is overcrowding, bad sanitation, improper heating and damp dwellings. It is of great importance because of its contribution to cardiac (heart) invalidism and deaths, both during childhood and later adult life."

The exact germ which causes the ailment is not known, but it is suggested that probably the germ, whatever it is, remains alive in the body tissues over long periods of time, repeatedly flaring up to cause more attacks of illness. No idea of the actual number of cases of the ailment is possible because the disease is not reportable like scarlet fever or measles. It is generally estimated to make up from three to seven per cent. of the medical diseases observed in children's hospitals. Girls seem to be somewhat more susceptible to this ailment than boys.

Dampness and chilling are regarded as important factors in the disease. The general use of natural gas for cooking and heating is, in the opinion of Drs. Pounders and Gray, responsible for producing artificially in the semi-arid southwest the damp environment that is strongly conducive to this illness. This natural gas, being a hydrogen gas, it was explained, produces a great deal of moisture when burned. The very poor people in this region who live in tents and shacks do not have as much of the disease as the better class of poor who burn gas in tightly constructed, poorly ventilated dwellings, where it is not uncommon to see the furniture, walls and ceilings literally dripping wet in cold weather.

For treatment of active cases of rheumatic fever Drs. Pounders and Gray advised long periods of rest, nourishing food and proper hygiene with a gradual resumption of exercise after activity of the infection is thought to be arrested.

MALARIA IN THE SOUTHERN STATES

MALARIA in our southern states is so wide-spread and such a "stupendous" problem that it probably can not be wiped out during the lifetime of the present generation

of inhabitants, members of the National Malaria Committee, meeting in Oklahoma City on November 17, were told by Colonel W. N. Bispham, of the U. S. Army Medical Corps.

The total number of persons infected with malaria in seven southern states, South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi and Louisiana, is 1,600,000, according to Colonel Bispham's estimate. Nothing like the total number of cases is reported to health authorities. He charged both authorities and practising physicians with lack of concern or of taking a hopeless attitude toward the problem.

He stated that "Malaria infection in the southern states is a very serious problem which has received very little recognition not only by the governing authorities but also by the medical profession. This is a very comprehensive statement and it may be challenged, but an extensive study of the disease in all the southern states except Arkansas and Texas and contact with health officers and practising physicians throughout this area has confirmed this opinion. During the last few years considerable amounts of WPA funds were allotted to states and counties for the prevention of malaria. Most of this money was expended by state and county officials without expert supervision, and though it is acknowledged that probably a number of very bad breeding areas have been eliminated, the work has proceeded in such a way that the neglect of a few years will duplicate the condition remedied. The money provided has been spread over such a large area that there has been no effect on the death rate and apparently the number of cases remains essentially the same."

Colonel Bispham outlined a plan which he said is the "only way to conduct malaria prevention work successfully." This consists in selecting an area of suitable size, preferably a county, where malaria is so prevalent as to seriously menace health and where the support of authorities and population can be relied upon. A complete examination of school children should then be made to determine the amount and type of infection and the location of malaria infection in the county. A survey of all mosquito breeding places within a mile of each such spot or focus of malaria infection should then be made by a mosquito expert. Next an engineer familiar with eradication of mosquito breeding areas should survey the area, and after this plans for mosquito eradication can be made and money allotted to cover the necessary costs. In addition a campaign of education on malaria prevention should be instituted and complete treatment of all infected persons should be provided.

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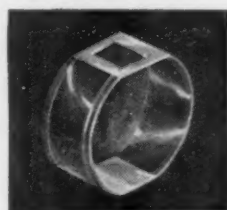
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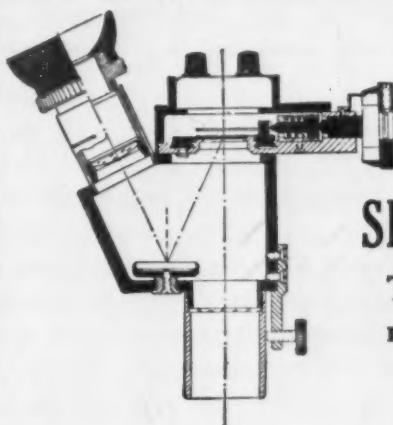
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so possessed an enormous gravitational force which would act strangely on the light which they might emit.

This gravitational force would do two things, according to Professor Fritz Zwicky, of the California Institute of Technology, in the *Astrophysical Journal*. It would make the light from these stars slow up so that it would take the rays an infinitely long time to reach an external point. And the light—even if it did arrive—would reach an external point with zero energy and hence could not be detected by any instrument known to science.

Such stars would be of a type called collapsed neutron stars and would represent the lowest states of energy which matter could possess without actually turning into radiation. It is believed that neutron stars are the final end product of those enormous stellar flareups known as super-novae which, about once in 300 years in our galaxy, flare up to super-brilliance and then quickly drop back to obscurity. The concept of collapsed neutron stars was postulated to explain the amazing outpouring of radiant energy which super-novae possess for their brief period of brightness. While astronomers can not, of course, hope to observe the stars which have reached the final paradoxical state cited here, they can study stars which apparently are passing into the collapsed neutron state.

One super-nova, known as IC 4182, reached its maximum brightness in August, 1937, and has since been watched closely. The estimated surface temperature of the central star of this super-nova is about 3,100,000 degrees Centigrade. Its density is such that a cubic centimeter of it would weight about 2,460,000 pounds. And in a year of observation its light characteristics, as determined by its spectrum, shifted toward the low energy, or red colors, by an amount of 100 Angstrom units, an amazingly large displacement attributed to growing gravitational forces on the star.

ACOUSTICAL PROPERTIES OF THE VIOLIN

A MODERN maker of inexpensive violins has at least approached the secret of the old Italian masters, according to a report by Professor Frederick A. Saunders, of Harvard University, to the American Acoustical Society. Tests show that a \$200 German instrument, copied after an old master, produces steady tones whose quality is closely similar to that of one of the best old Italian violins.

The modern violin was made by Dr. F. J. Koch, of Dresden, a distinguished electrical engineer who has supported the manufacture of fine violins as a separate interest. Dr. Saunders did not disclose the identity or make of the old violin. While asserting that the report contains the best evidence he has yet obtained that the secret of Italian violin mastery may be within reach, Dr. Saunders pointed out that his tests are only partial. He has concentrated on finding the variation from note to note in the musical scale of the strength of the natural vibration and sound emission of a violin. Every violin has its individual points of strong and weak vibration, and for the most part this determines the tonal quality of the instrument. But there is a strong possibility, as yet unexplored, that the tone quality depends also on the quickness—measured in thousandths of a second—with which the violin body responds to string vibration.

Dr. Saunders has tested the acoustical properties of violins for many years, seeking an impartial answer to the question whether the old master Italian violins are actually superior in tone, and, if so, how modern violins can be made inexpensively to duplicate these tones. He has studied 37 instruments, including several by Stradivarius, by the Gaurnerius family and other famous makers.

Two weeks ago the celebrated violinist Jascha Heifetz assisted Dr. Saunders by bowing his violins before the Harvard microphones. Dr. Saunders' tests are made with an automatic sound analyzer which in a few seconds makes a photographic record of the relative strengths of all the harmonics—fundamental tone and overtones—of a musical note. Each of the sixty-four notes of a violin is separately recorded, and the harmonics are tabulated according to strength. From these data a response curve can be drawn showing clearly the frequencies at which the violin has strong natural resonances, and also where the sound emission is weaker.

Dr. Saunders showed that the response curves for the Koch violin and the old Italian instrument were almost identical in strengths and weaknesses from the lowest to the highest notes.

INDUSTRIAL ADVANCE IN THE SOUTH

REMARKABLE as are the opportunities for industrial growth in the South, there must be no expectation that advancement of southern industries can be achieved by some semi-magical means which is the special property of the land south of the Mason-Dixon line.

This, in summary, was the advice of Dr. Harrison E. Howe, editor of the American Chemical Society's official journal, *Industrial and Engineering Chemistry*, presented on November 18 to the symposium on the Changing Economic Base of the South. This symposium was sponsored by Duke University, Durham, N. C., in connection with its centennial celebration.

The South has an excellent chance for major industrial gains by the study and solution of its own special problems. While it may gain some industry through migration of plants to the milder climatic conditions and because of lower cost of building construction, it must not place too much reliance on making its gains at the expense of other industrial sections of the nation. Dr. Howe pointed out that the factors of favored climate and lower construction costs often are balanced in the end by the greater freight charges required to bring the manufactured merchandise back into the large buying markets of the East and Central West.

The growth of the newsprint paper industry and the development of an industry to utilize sweet potato starch were two examples cited by Dr. Howe as important and soundly-based industries of the South founded on time-tried principles of scientific research. Much more can be done by a sound application of scientific advance to the local problems of the South than can be achieved by any other method.

PENNSYLVANIA AMATEUR RADIO OPERATORS

TWENTY-SEVEN "ham" radio operators, linked in the Susquehanna Emergency Network, on November 19, demonstrated to radio listeners in the eastern part of the

United States how they and their comrades of the ether have served isolated communities in the past and what they will do in the future if flood waters come again to the Susquehanna Valley.

Under the leadership of their network control, Charles G. Landis, of York, who operates Station W3UA, stages monthly emergency communications drill to keep in tune for efficient operation whenever their services are required. Amateur radio operators, almost all of whom are members of the American Radio Relay League, have provided invaluable communication facilities in the past whenever disaster cut off ordinary means of communication. Many of them operate on batteries or have their own small power plants, thus being independent of local power supplies which usually go out with the wires. This is not true of most commercial radio stations.

Messages, most of them in voice, but a few in code, are transmitted by the operators to Mr. Landis's station. He in turn relays them to Roy Corderman, W3ZD, of Chevy Chase, Md., on the outskirts of the District of Columbia. Mr. Corderman relays the messages by telephone to the American Red Cross headquarters in Washington or to other parties concerned with emergency work. Mr. Corderman and the amateurs behind him were the ones who kept the Red Cross in close touch with isolated communities such as Westerly, R. I., during the recent New England hurricane.

On November 19, Chairman Frank R. McNinch, of the Federal Communications Commission, emphasized the importance of the amateurs in keeping lines of communication open; Merrill Bernard, chief of the river and flood division of the U. S. Weather Bureau spoke of the part played by the radio "hams" in supplying flood data, and James L. Fieser, vice-chairman of the Red Cross, emphasized amateur emergency aid over the same commercial network to endorse the amateur network idea. Several other such chains have already been set up for emergency use in other parts of the country; they hope to encourage the formation of still others.

ITEMS

DANGER to our elms lurks in woodpiles containing elm logs with the bark on, according to Dr. J. H. Faull, of the Arnold Arboretum. In the Dutch elm disease area, these logs often harbor infected elm bark beetles, ready to fly on and spread the infection as soon as spring comes. Such wood should all be burned before the end of cold weather.

LEAFY spurge, one of the worst weeds in the Northwest, can be kept down, experiments at the North Dakota experiment station have shown, by close grazing with sheep. Ewes lost weight on it (which they also did on grass pasture) but lambs gained better on the spurge than they did on grass.

DUTCH chemists have developed successfully a synthetic plastic material derived from potato flour, it is reported from The Netherlands. The new product is called "an-ras-glass" in its transparent form and "amylite" in opaque form. It is said to be easily bored, sawn, ground, bent, shaped, colored and decorated.

ELECTRICALLY charged wire fences can have other than military uses. At the North Dakota experiment station, a device for sending a six-volt current through a fence has been developed by H. F. McColly, agricultural engineer. The current is low enough so as not to injure livestock, but strong enough to make them steer clear of the fence after touching it once or twice. It is not sent continuously but in intermittent "jolts," which gives maximum effect and also saves electricity.

TEN of Kansas State College's unique white poultry have been sent to Sweden where they will be used in genetics experiments, according to letters from Dr. Gert Bonnier, geneticist at the Institute for Hufdursforadling at Wiad, Sweden. The unusual poultry have white plumage, frizzled feathers and crested heads. They are said to be the only fowls in the world that combine these three characteristics. Dr. Bonnier wrote to Dr. D. C. Warren, professor of poultry husbandry at Manhattan, Kansas, that he was unable to find poultry with these three characteristics desired for his genetics experiments anywhere in Europe. "The birds are not of any recognized breed," said Dr. Warren. "Their combination of characteristics makes them admirable subjects for research in the field of genetics."

GREAT quantities of bones of Ice Age animals have been dug out of asphalt deposits known as the McKittrick tar seeps, about 30 miles west of Bakersfield, Calif., by a party working under the direction of Dr. Chester Stock, of the California Institute of Technology, and research associate of the Carnegie Institution of Washington. The fossils are similar in many respects to those of the same age found in the famous La Brea pits in Los Angeles. They include sabertooth cats, giant lions, short-faced bears, grim wolves, as well as the more numerous remains of the herbivorous animals that attracted them, such as bison, horse, camel, musk-ox, deer, elk and pronghorn. There are also many bird bones, especially of waterfowl, suggesting that at some time there was a lake in the region, despite geological evidence that during the Ice Age conditions there were considerably more arid than they are now.

A NEW compact voltage regulator for industrial electrical generators has been announced by C. R. Hanna, of the Westinghouse Research Laboratories. The device is designed for plants producing their own power. The device keeps independent generators giving power at constant voltage, regardless of the load on the power line in the installation. Ordinarily such generators have the human-like trick of lagging at their work when heavily loaded. They also produce too much voltage when the power load, drawn from them, is light. A past method of overcoming this difficulty was to have a man regulate the generator's output by hand control of rheostats. The new device consists of a number of graduated electrical resistances which can decrease or increase the generator's speed, and hence its power output. The selection of these resistances is effected automatically.

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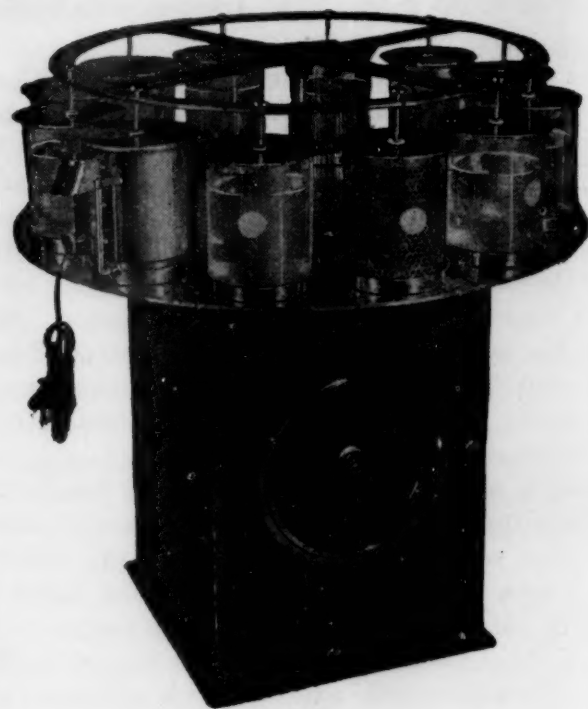
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SCIENCE NEWS

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SOME PAPERS READ AT THE CHICAGO MEETING OF THE AMERICAN PHYSICAL SOCIETY

HIGH altitude research at 14,200 feet has led to the identification of what physicists believe will be still another atomic particle known as the neutretto. The newest particle is without electrical charge and has the mass and other properties of the heavy electron. The latter has been known by a variety of names, including barytron. Recently, Dr. Carl D. Anderson and Dr. Seth D. Neddermeyer, of the California Institute of Technology, suggested still another name—the mesotron—for the heavy electron, in order to bring some order out of the chaos of nomenclature for this intermediate mass particle. Mention of the discovery was made in the report of Francis R. Shonka, of the University of Chicago and De Paul University, to the meeting of the American Physical Society. Mr. Shonka's report was introduced by Professor Arthur H. Compton, of the University of Chicago. The new research, leading to the discovery of the particle, consisted of measuring cosmic ray intensity at high altitudes when various thicknesses of lead were placed in several selected positions about the four Geiger-Muller detecting tubes. Great thicknesses of lead were required to bring out the maximum observed effects. "In view of the great thickness of lead required to give the maximum effect, these non-ionizing particles producing secondary barytrons (heavy electrons) must be much more penetrating than photons. This high penetrating power suggests their identification with the neutrettos (neutral particles having mass and other properties similar to the barytron) postulated by Heitler."

WORLD-WIDE variations of cosmic ray intensity can be explained by the presence of a great ring of electricity whirling around the earth, far out into space. Dr. S. E. Forbush, of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, stated that this ring of electricity is the same mechanism which can account for the drop of cosmic ray intensity that occurs during severe magnetic storms. Electrical rings, he added, were first postulated by Dr. Carl Stormer, of Norway, to explain certain characteristics of the aurora. The magnetic effect of the current in this ring of electricity, plus the magnetic effect of the earth's permanent magnetic field, would be expected to have a result equivalent to an increase in the earth's magnetic field. Such an increase, in turn, would account for a decrease in cosmic ray intensity. World-wide cosmic ray variation, Dr. Forbush explained, can be accounted for by the radius of the electrical ring of current and by the amount of current flowing in it.

PROFESSOR A. H. COMPTON and Dr. P. S. Gill, of the University of Chicago, reported that a comparison of all available data on cosmic ray intensities in relation to star, or sidereal, time shows that cosmic rays apparently

originate within the same galaxy of stars as that which contains the earth and the sun. There is no evidence, they said, to indicate that the earth is moving appreciably with respect to the source of cosmic rays as would be the case if the rays came from outside the local galaxy.

USING the diffractive scattering of x-rays by molten sulfur, Professor Newell S. Gingrich, of the University of Missouri, has found a new orderliness in the liquid state of nature which ordinarily is considered without form. He described studies showing how liquid sulfur diffracts x-radiation in a manner which suggests that the atoms of sulfur possess a grouping at a distance of 2.05 Angstrom units. An Angstrom unit is a special standard of length used in spectroscopy which is equivalent to only .000,000,003,937 of an inch.

NEW studies which disclose the effects of bends in long chain molecules were described by Professor William D. Harkins and Robert T. Florence, of the University of Chicago. Using thin films of materials, only one molecule thick, the scientists investigated the shape of otherwise identical molecules as they affected the attraction between the molecules in the film. Stearic acid and stearyl amine with a straight chain of atoms in its molecule, elaidic acid with the same number of atoms in its chain but with a slight bend in the molecule, and oleic acid with a much larger bend, were all studied. Elaidic acid, which gives an extended type of film, was added to stearyl amine that ordinarily, of itself, gives a condensed type of film. The result was the formation of an even more condensed type of film. In contrast when stearyl amine, which gives a condensed film, was added to an expanded film of oleic acid it expanded it even more. These apparently contradictory effects can be explained by the differences in the bending of the molecules which has a great effect on the intermolecular attractive forces in the films.

To facilitate the control of energy of the particles, which are accelerated in cyclotrons for atomic bombardment, a new method has been devised. This was reported by J. L. Lawson and A. W. Tyler, of the University of Michigan. Using vacuum tubes a circuit has been designed which handles 250 amperes of current and keeps it accurate within one part in 5,000 even though the power supply voltages may vary by as much as 20 per cent. Control of the current flowing in the cyclotron is highly important for long periods because on this current is based the magnetic field of the instrument. In turn the steadiness of the magnetic field in the cyclotron determines the constancy of the energy of the accelerated particle beam which is used in atom smashing.

New improvements in cyclotron technique are now enabling the bombardment of hitherto difficult targets like metallic sodium, according to Dr. Franz N. D. Kurie,

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of Indiana University. Previously, he pointed out, it had been impossible to work with some materials because they spattered or could not be cooled when they were bombarded with the full power of the beam in the cyclotron at the University of California. New advances have stepped up the power in this beam, at the point where it strikes the target, to a kilowatt. A small chamber has been constructed, containing the sample to be bombarded, which is placed at the window of the cyclotron from which come the high energy atomic particles. In the chamber is a copper target plate whose back surface is water-cooled and whose front surface is heavily knurled. The material under study is either fused to this copper plate or pressed into the depressions with a spatula. In special cases a thin film of gold is used to cover the material and further protect it. When filled with hydrogen or helium gas this tiny chamber is placed in position. The presence of the gas helps keep the front window of the chamber cool. "With this arrangement," Dr. Kurie stated, "it has been found possible to bombard red phosphorus, sodium metal, lithium metal and other difficult targets with the full intensity of the cyclotron."

THE TANGANYIKA TERRITORY

OPPRESSED and battered Jewry's new Promised Land—Tanganyika Territory in East Africa, the most frequently mentioned colonization site—is one of the few sparsely settled districts in the world that still has areas in which Europeans will find it possible to live.

They won't find it easy, though, the best information available indicates. For it will take hardy pioneers—even harder than those who opened up America's West or who are opening up to-day Siberia's North—to wrest a living from the former German colony, even though it is twice the size of the Nazi Reich from which they wish to flee.

The coastal plain is hot and damp; in it most of the 2,500 Europeans already in the territory are concentrated. In the interior is a hot and dry plateau to which city dwellers, in which classification most Jews belong, will find it no easy task to become accustomed. There is only one town of any size—Dar es Salaam, seat of the British authorities who govern by mandate from the League of Nations.

Yet with only some 5,000 Asiatics and 5,000,000 African natives, space for the new immigrants might be found. It may be tough on the natives, however; Britain in 1923 set the territory aside as one in which maintenance of the native tribes would be particularly favored. Some 75 native tribes, belonging mostly to the Bantu races, fill out most of the 365,000 square miles comprised in the British part of the territory. The former German colony was slightly larger, as two slices were given to Belgium and Portugal in the settlement following the World War.

Sisal and rubber are the principal exports, though cotton, coffee and lumber can be developed into profitable industries. Gold, mica, tin and diamond deposits might be made to produce by an industrious people, such as the Jewish people now in Palestine. An excellent basic network of transport and communication lines already exists.

Twelve hundred miles of railroad and 15,000 miles of roads, easily traveled during the dry season, link the principal districts. Telegraph lines connect Dar es Salaam and many inland towns. The farm and range districts support 5,000,000 cattle, more than 2,000,000 sheep and 3,000,000 goats.

Tanganyika Territory, the largest of the old German colonies, is also considered to be the most desirable and the one most capable of development and exploitation. Perhaps, if the region is turned over to the Jews as a new national home, it will be so developed.—LEONARD H. ENGEL.

ITEMS

SEEKING a barking deer, an animal so rare that no museum in the world now contains a specimen, Arthur Vernay, C. Suydam Cutting and Dr. Harold E. Anthony set out from the American Museum of Natural History, New York City, on November 26, to traverse hitherto unexplored parts of northeastern Burma. *En route* they will be joined by J. K. Stanford, former deputy commissioner of Myitkyina, Burma, and Kingdon Ward, British botanist and plant collector. The expedition will be in the field until May. Besides the barking deer, they will collect specimens of the giant panda and the takin, which is a small but formidable buffalo, and also other species of mammals, birds, fishes, insects and plants. All botanical material taken will be divided between the New York Botanical Garden and the Kew Gardens, England.

A SCIENTIFICALLY designed little megaphone, one foot long, which would be far more efficient for football cheerleaders than the ordinary long ones, was described at the meeting in Cambridge of the Acoustical Society of America by Professor F. R. Watson, of the University of Illinois. The megaphone, which is an adaptation of acoustical principles known for many years, is shaped like a triangle two inches thick. It has a rectangular mouth about 12 inches high by 2 inches wide. Sound enters through an opening two inches square. The sides are flat. If the long side is held vertical, sound billows out of such a megaphone in a semicircular sweep which can take in one whole side of a stadium at once. The ordinary cone megaphone focuses sound on a relatively limited area. Professor Watson said that he has made up some of his new megaphones for football cheerleaders, but that there seems to be a preference still for the more spectacular, if less efficient cones.

NAMING the California Institute of Technology observatory on Palomar Mountain, site of the 200-inch telescope, in honor of the late Dr. George Ellery Hale, is being considered seriously. That Dr. Hale's name will form the permanent name for the observatory, is the hope of Captain Clyde S. McDowell, supervising engineer, who held that the man who envisioned the project be so honored. No formal action as to the selection of a name has been taken, however. At the time of his death Dr. Hale was in charge of the enterprise, and wrote the magazine article which resulted in the project's endowment.

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SCIENCE NEWS

Science Service, Washington, D. C.

RADIOACTIVE DISINTEGRATION OF MESOTRON PARTICLES

STONE walls may make a prison and strong armor plate will stop a shell, but physicists are now studying an amazing atomic particle which will penetrate dense solid material better than it will air or a gas. The particle is the heavy electron discovered in 1937 by American scientists in cosmic ray studies, to which the name mesotron has now been given.

In two reports published in *Nature*, Dr. P. M. S. Blackett, of the University of Manchester, and Dr. Bruno Rossi, Italian physicist now at the Institute for Theoretical Physics, Copenhagen, describe new properties about the strange mesotron. The mesotron has an electrical charge like an electron but has a mass intermediate between that of an electron and a proton. Dr. Blackett states that the mesotron has been shown to be radioactively unstable and breaks down with a mean time of decay of about 0.000002 seconds (two millionths of a second). It is this hitherto unrealized instability which explains the baffling differences of absorption of mesotrons in air and in dense materials like lead. It is this factor, probably, which explains the discovery that mesotrons penetrate deeply into the earth and appear in experiments performed deep under ground in mines and in caves.

Dr. Rossi reports experiments made at altitudes of 7,775 feet in which it was found that the mesotrons were much more reduced in intensity in passing through air than they were in passing through an equivalent amount of dense lead. "The difference between the lead and the air absorption," according to Dr. Rossi, "for which no satisfactory explanation had been found at that time, can now easily be accounted for on the disintegration hypothesis (of mesotrons)."

The seemingly queer disintegration of a single atomic particle is explained by saying that the mesotron breaks up into an electron and into a neutrino with the original heavy mass of the mesotron appearing in its offspring as great kinetic energy.

TANGANYIKA

TANGANYIKA, most discussed among potential new Promised Lands for Jewish exiles, could be made literally a land of milk and honey by industrious colonists who know how to farm and can adapt themselves to life in the tropics. Such is the opinion of Dr. H. L. Shantz, of the U. S. Forest Service, based on two visits to the territory during which he made studies of the ecological conditions that influence possible agricultural and ranching uses of the land.

Tanganyika is a big country, bigger even than Ethiopia, Dr. Shantz pointed out. Except for a malarious coastal strip, it offers good living conditions for white men, for although the climate is tropical it is never really hot.

The total area of Tanganyika is about 366,000 square miles, of which 299,000 square miles is potentially pro-

ductive land and 67,000 square miles is desert or otherwise unusable. There is relatively little dense forest—only about eight per cent. of the total, or 11,000 square miles. The greater part of the natural cover is a kind of savanna-like open forest, with trees standing scattered in grass-land, as in a park. About 111,000 square miles carry this type of vegetation.

Of especial interest from the colonization point of view is the fact that a generous section of the country will grow temperate-zone crops, especially the small grains, and at the same time will produce bananas and coffee. This "cool-weather crop" area comprises some 56,000 square miles—a block about the size of Iowa or Wisconsin, and nearly one third the size of all post-war Germany. In addition, there are "warm-weather crop" areas totaling 243,000 square miles, capable of producing cotton, corn, casava, coconuts, etc.

The grazing possibilities of Tanganyika are very great. Approximately 289,000 square miles might be used for high-production ranch lands, with an additional 66,000 square miles capable of carrying smaller numbers of cattle, sheep and goats. At present, the livestock population, owned principally by natives, comprises nearly five million cattle and more than five million sheep and goats. There are still enormous herds of big game, ranging all the way from elephant and rhinoceros to antelope and apes. Problems of wildlife adjustment will come very much to the fore if extensive European colonization is undertaken.

Under cultivation at present are about two and one half million acres in large European-owned plantations and over four million acres farmed by natives. The plantations produce money crops, principally sisal, coffee, cotton and corn, with a few coconuts. The natives raise a great variety of crops, principally for their own use. Millet is the great food grain of the natives; more than a million acres are in that crop alone. Others are corn, wheat, potatoes, beans, peas, bananas, peanuts, tobacco, sisal, cotton, etc.

At present there are so few white men in Tanganyika that they fairly rattle around in the country. There are only about 6,600 of them, embedded in a dark matrix of nearly 4,800,000 Negroes and 24,000 Asiatics. The possible effects of rapidly introducing half a million or more white people into the land are hard to calculate.—FRANK THONE.

THE EXTINCT ANTHROPOID APE
PARANTHROPUS

THREE broken pieces of bone, newly found at Kromdraai in South Africa, give strong evidence that the extinct anthropoid ape *Paranthropus* walked on two legs like a man. The discoverer, Dr. Robert Broom, of the Transvaal Museum at Pretoria, reports his find in *Nature*.

The three bone fragments, which Dr. Broom states almost certainly belong to *Paranthropus*, are the lower end of a right humerus (the elbow), the lower end of

one of the bones of the right arm, and a bone of a toe. So nearly human are these three bones, that Dr. Broom says that they are almost indistinguishable from those of a man. They are quite unlike the corresponding bones in either chimpanzee or gorilla. But as Dr. Broom, in sorting over between three and four thousand bones which have been collected from the Kromdraai site, has not found a single bone or tooth belonging to man, and the bones now found were quite close to the place where the skull lay, he feels justified in attributing them to *Paranthropus*.

The great importance of this discovery, however, does not lie merely in the close resemblance of these bones to those of man. Not only do they confirm Dr. Broom's conclusion from the conformation of certain bones of the skull, that this man-like fossil walked upright when he was alive, but they extend it. The toe bone is a little longer than that of man, but it belonged to a foot which was habituated to upright walking, while the humerus reveals that the upper limbs were not used for locomotion. Hence the upper limbs of *Paranthropus* were freed for that development of the use of arm and hand which led to the specifically human activity of tool-making, as well as tool-using, this activity in its turn helping on the development of the distinctively human characters of the brain.

The discovery of part of the thighbone of the Sterkfontein fossil, to which Dr. Broom has given the name *Plesianthropus*, on account of its resemblances to man, indicates that this anthropoid also probably walked upright.

A further discovery at Sterkfontein is that of the brain cast of what, it is believed, must have been a male skull of *Plesianthropus*. It is considerably larger than the brain cast made from the type skull which was found at Sterkfontein, and is believed to be that of a female. The new brain cast has a capacity of from 600 to 650 cubic centimeters.

The new skull of *Pithecanthropus erectus*, the ape-man of Java, which was found recently, has a capacity of 750 cubic centimeters, so that Dr. Broom's Sterkfontein brain cast comes very close to that of a skull which is regarded definitely as coming within the human line.

On the evidence of the fossil teeth of horse which have been found on the Kromdraai site, Dr. Broom now thinks that the Kromdraai skull may be considerably older than was at first estimated, and possibly belongs to the middle period of the Pleistocene, or Ice Age.—E. N. FALLAIZE.

ROCK FOOTPRINTS

GEOLOGY and ethnology seem to be at odds regarding the nature of the now famous impressions in the rocks, shaped somewhat like human footprints yet certainly not made by human feet.

Geologists for the present are confining their attention mainly to two sets of the markings, both near Berea, Ky., which Professor W. G. Burroughs, of Berea College, is sure were made by actual animal feet, back in Coal Age days when the stuff that is now stone was soft, wet sand. He has the backing of Charles W. Gilmore, of the Smithsonian Institution, who calls attention to the fact that

tracks in other localities that most nearly resemble the Berea prints are in rocks of the same geological age. Mr. Gilmore has not visited the Berea site, but he has examined critically detailed photographs of the markings.

So confident is Professor Burroughs that the tracks are real footprints that he has given the unknown animal a scientific name, *Phenanthropos mirabilis*. The name was suggested by Dr. Frank Thone, editor in biology of Science Service, with the concurrence of Mr. Gilmore. The first part of it translates as "looks human," and the second word simply means "remarkable." Dissent is registered by David I. Bushnell, Jr., Smithsonian Institution ethnologist. Mr. Bushnell said, in a statement issued to the press, that every print he examined was undoubtedly an Indian carving. A prehistoric tribe or tribes, he believes, attached to them some symbolic meaning. The disagreement may be more apparent than real. Unquestionably many, perhaps most, of the footprint-like marks in the rocks over a wide stretch of country were carved by human sculptors. Their artificial nature is manifest at a glance, especially when they are found paired, arranged in even rows, and accompanied by other symbols such as circles and three-pronged figures like great bird tracks.

It is quite as possible that other tracks are genuine footprints, especially when they are arranged quite at random, as the Berea tracks are, and where the prints vary greatly in size, as some of them do. It is this circumstance, in part, that has convinced Professor Burroughs that the Berea markings are not artificial.

Dr. Alson Baker, a physician of Berea, recently wrote Science Service that he and Dr. A. F. Cornelius had made a critical examination of the tracks there, using a strong magnifier mounted on a tripod. He states: "We examined the arrangement of the sand grains in the deepest portions of the prints, with especial attention to the heels. The sand grains in the bottoms of the prints were much more closely packed than those in the slopes, and those in the slopes were more closely packed than those in the rock an inch from the margins of the prints, or at any other point. Each member of the party certified and checked these findings and we all agree that the imprints were made by pressure when the sand was soft and wet. The fact that the sand grains in the bottoms and slopes of the imprints are of exactly the same kind as those in all other parts of the rock surface examined, seems to prove conclusively that the closer arrangement observed was not due to any possible drifting in of extraneous material."

NEW CHEMICAL USES FOR MILK WASTES

YOUR next automobile may be a milk wagon—parts of it, at least, made from chemicals derived from dairy wastes. Milk products may be in the lacquer that shines on its body, also in the plastic glass in its shatter-proof windshield.

In his annual report to the Secretary of Agriculture, O. E. Reed, chief of the Bureau of Dairy Industry, tells of a new resin made from lactic acid by chemists of the Department of Agriculture. It promises to be useful in the varnish and lacquer industries. A method is now

being worked out for turning lactic acid into acrylic acid, a glass-like transparent plastic.

Lactic acid, which already has a number of other industrial uses, is manufactured, by a process originated in the bureau, from whey, the thin waste liquor which is all that is left of milk after the production of cheese. Another profitable outlet for whey, which has for years been a burdensome waste in the cheese industry, has been found in the extraction of milk sugar from it by a method which produces a soluble albumin and a residue rich in flavins. The albumin is useful in infant foods and the flavin product is in demand by feed manufacturers.

A method for making a synthetic wool-like yarn from casein has also been developed. This was first done in Italy, where the process was kept secret. The American chemists developed their own method and made the process available to everybody by putting it under a public service patent. Although large quantities of casein "wool" are now being manufactured in Italy, it has not yet been considered economically justifiable to put its American counterpart into commercial production.

HIGHWAY SAFETY

OUT of the thrilling curves of giant roller coasters in amusement parks has come the newest idea for increasing highway safety.

Parabolic deflection down the center line of a roadway have been found to give positive redirection to a speeding motor vehicle which may strike them, it was reported to the meeting of the Highway Research Board in Washington by Dr. Miller McClintock, of the Bureau of Street Traffic Research of Yale University.

The parabolic barrier wall, Dr. McClintock said, was an outgrowth of observations in amusement parks where the cars of a roller coaster negotiate curves which are so sharp that neither flanges on the wheels nor super-elevation of the curve would normally keep the car on its track. On roller coasters the trick is to have the side of the car mounted with rollers so that an additional restoring force is obtained. Adapting this idea for a central barrier wall Yale traffic experts devised a sloping metal surface whose profile is a parabolic curve.

As the front tire of a car starts to ride up this surface it gradually reaches a point where the side walls of the tire press against the barrier wall. This creates a restoring force which redirects the car away from the barrier and back on to the roadway. The action is positive and gentle if the driver only allows the car to guide itself for the instant it is on the barrier. No part of the car, except the sides of the tires, touches the barrier wall. Extensive tests of the barrier have been made in cooperation with the Michigan State highway department, Dr. McClintock said, with all types of motor vehicles, from light passenger cars to 15-ton trucks, and at speeds from 10 to 60 miles an hour. In no case was any car out of control, damaged in any way or the occupants harmed.

A full size parabolic deflector would be four and a half feet high and four feet wide at its base. It would be adapted for any highways wider than two lane roads.—ROBERT D. POTTER.

ITEMS

A NEW seismological observatory has been established by the University of California, in the town of Mineral, which is situated in Lassen National Park, near the only active volcano in the United States proper. This is the seventh station for the study of earthquakes to be established in the state by the university. Setting up instruments at Mineral does not mean that seismologists expect renewal of volcanic activity on the part of Lassen peak, it was explained, but only that a station was needed in this part of the state, and that its work can be facilitated by the presence of scientists of the National Park Service in the region, together with the cooperation of the Seismographical Society of America.

THE U. S. Public Health Service reports that the number of influenza cases has been greater this fall than during the same period last year or than the average for the five-year period ending in 1937. For the four weeks ending November 5, there were 3,836, which is about 50 per cent. higher than the average for the five-year median, 1933-1937. For the week ending November 19, latest on which figures for the whole country are available, there were 1,207 cases reported. Probably about three times that many occurred, as health officials have found that only one third of the total number of influenza cases is likely to be reported.

At least 10,000,000 Americans suffer from some form of the now fashionable ailment known medically as an allergy, according to an estimate made by Dr. Theodore D. Beckwith, professor of bacteriology at the University of California. Allergy is described in the statement as being a condition of hypersensitiveness to certain foods, drugs, animals, plants, climatic conditions and emotional disturbances. Hives, hayfever, asthma and sick headaches are among the ailments suffered by allergic persons when in contact with the particular offending substance.

YOUNG men of the CCC camps were given credit for saving millions of acres of farm and pasture land, in a communication from H. H. Bennett, chief of the Soil Conservation Service, to Robert Fechner, director of the Civilian Conservation Corps. Mr. Bennett said that CCC camps furnished 70 per cent. of the labor used to advance the soil conservation program. In fighting gullies, the last and worst stage of soil erosion, CCC workers have built almost 3,000,000 check dams, dug 48,000,000 linear feet of diversion ditches and seeded or sodded 300,000,000 square yards of gullied land. In combating the less spectacular but more insidiously destructive sheet erosion, they have planted approximately 500,000 acres, put in 18,000 miles of terraces and 41,404 miles of contour furrows and quarried 1,403,659 tons of limestone.

THE "absolute altimeter," introduced to the aviation industry a month ago by the United Air Lines and the Western Electric Company and potentially probably the single most important air navigation advance in years, is now being checked by the U. S. Army Air Corps at Wright Field, Ohio. The instrument warns of obstacles such as mountains, since it records height over land or other obstructions, and not height above sea-level.

NEW BOOKS

*The Structure of
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Professor of Botany, University of Chicago

tato, the tomato, squash, and lettuce. Throughout the book the dynamic, developmental aspects of plant anatomy have been as fully discussed as the morphological. Valuable, up-to-date bibliographies are given at the end of each chapter. A ten-page glossary of scientific terms is appended to leave no doubt as to the meaning of terms employed in the book. There are 340 illustrations, more than half of which are original. \$4.90

*The Phylum
Chordata*

by H. H. NEWMAN
Professor of Zoology, University of Chicago

of the work adequately covered in the laboratory—this book deals with the Phylum Chordata as a whole, the evolutionary history of the group, the interrelation of surviving groups, the general biological principles illustrated by the phylum, and significant aspects of the natural history of the chordates such as their modes of life, special adaptations, habitat, distribution, breeding habits, etc. It provides an excellent text and reference book for the lecture part of an interesting course in vertebrate zoology. To be published in December. \$3.75 (probable)

This book provides for the first time a comprehensive summary of all research bearing on the structure and developmental anatomy of sixteen important economic plants. The first part of the book gives a digest of the principle facts of plant anatomy in general as a background for the discussion of individual plants. The second part then treats in detail the following plants: corn, wheat, the onion, hemp, the beet, the radish, alfalfa, the pea, flax, cotton, celery, the sweet potato, the white po-

This new text is based upon the author's *Vertebrate Zoology*, but has been newly written to cover the many research findings which have accumulated since the original book was published. It is a book particularly well adapted to modern methods of teaching in that emphasis is put on the broad underlying principles and a rich and interesting fund of related detail is included. Thus, instead of taking up in detail the comparative study of the standard representative species—a part

MACMILLAN

SCIENCE NEWS

Science Service, Washington, D. C.

THE ACTION OF ROCKS UNDER PRESSURE

NEW clues to the underground mechanism causing earthquakes, mountain formation and other geological phenomena have been found in the action of rocks under tremendous laboratory pressures.

David Griggs, junior fellow in geophysics at Harvard University, has utilized the high-pressure equipment of Professor P. W. Bridgman to duplicate the pressure conditions in the earth's outer crust—a granitic layer extending down 30 to 50 miles. Under the high confining pressures, which reached a maximum of about 300,000 pounds per square inch, it was found that limestone could be made to flow. A small block of it was compressed 35 per cent. in length without shattering. Contrary to past geologic beliefs it was found that, under high pressure, rocks will not flow indefinitely, but will break if deformation is carried far enough; and it was found that sudden differential stress is not required to produce fracture under high confining pressure, but that a strong steady differential pressure will cause fracture if applied long enough.

In the tests a specimen of rock is placed in a thick steel cylinder. Hydraulic confining pressure is applied through a liquid, or at very high pressures through lead. In addition a direct differential pressure is exerted on the specimen by a steel piston. Differential pressure used attains more than 1,500,000 pounds per square inch. The tests are made, it was said, under the highest one-directional stress ever controlled and measured in laboratory research. Quartz, which is geologically important as one of the commonest minerals, remained brittle under the very highest pressures. The only change in quartz, aside from fracture, was an alteration of optical quality known as "undulatory extinction." Prior to these tests it was thought that quartz might become plastic under the high pressures.

Mr. Griggs's tests show that the flow of rocks under pressure is mathematically similar to the flow of metals. Rock substances beside limestone in which flow has been observed in the laboratory include glass, rock salt, calcite crystals, talc, shale and marble.

The research has been supported by the Geological Society of America and Harvard University.

SPIN OF ATOMIC PARTICLES

THE spin of atomic particles, the same kind of whirling which makes a top stand up on a table-top when properly spun, is now enabling scientists to find a new simplicity in nature.

All the many atomic particles—the electrons, positrons, neutrons, neutrinos, deuterons, mesotrons and all the rest—are now known to fall into one of two simple categories. Either their nuclear spin falls into half integral or into whole integral differences.

In a reply to a query of Science Service, Professor J. Frenkel, theoretical physicist at the Industrial Institute in Leningrad, points out that all the atomic particles conform to either Fermi-Dirac or Einstein-Bose statistics,

special advanced kinds of mathematics developed to interpret their properties. Electrons, positrons, protons, neutrons and neutrinos conform to Fermi-Dirac statistics, Professor Frenkel says, and he suggests that they be called "odd" particles. The second kind of particles have whole integral spins, conform to the Einstein-Bose statistics and include photons, deuterons and mesotrons. These particles would be known as "even" particles.

In treating the particles by mathematics it turns out that Fermi-Dirac class particles can combine their half integrals of spin and thus turn over into the second kind of Einstein-Bose particles. Thus where two, four, six or any even number of them combine the result is that the Fermi-Dirac particles show properties closely like the Einstein-Bose particles. Where three, five, seven or any odd number of Fermi-Dirac particles combine they keep their original properties. Einstein-Bose type particles can not, of course, ever combine into the Fermi-Dirac type because of their whole integral spin values.

Professor Frenkel is the well-known physicist who also named excitons and phonons as new concepts in mathematical physics. Exciton is a term used to designate a state of excitation moving from one atom to another in a material body, as where light would be absorbed in passing through a material like glass.

The phonon is a fictitious particle bearing the same relation to a sound wave as a photon does to a light wave. The latter is defined as a packet, or bundle, of radiant energy whose magnitude is equivalent to Planck's constant "h" times the frequency of the wave of light. By analogy a phonon would correspond to some constant times the frequency of the wave of sound under consideration.

Professor E. Teller, of the George Washington University, who has been credited by Science Service with the introduction of the terms exciton and phonon, wishes to acknowledge Professor Frenkel's clear priority for the use of these terms.—ROBERT D. POTTER.

INFLUENZA AND COLDS

A NEW line of attack on the common cold and influenza is being made in the laboratories of the International Health Division of the Rockefeller Foundation. The attack is centering on changes occurring in the nasal lining membranes during a cold or an attack of influenza—changes which may give you resistance or immunity to colds and 'flu and similar infections of nose, throat and other respiratory organs.

Drs. Thomas Francis, Jr., and C. H. Stuart-Harris have found such changes in nasal membranes of ferrets which received repeated inoculations of influenza virus. If they could find a way to induce such changes by permanent alteration of human nasal linings, it might be possible to confer resistance to influenza and the common cold in man.

The changes in the ferret nasal membranes, described in the current issue of the *Journal of Experimental Medicine*, are changes not so much in the structure of the

membranes as in their functioning. In the ferrets the changes result in complete resistance not only to the influenza virus itself but also to chemicals. The immunity or resistance thus induced is entirely a matter of cell resistance and has nothing to do with immunity in the usual sense. The latter immunity depends on the existence in the blood of germ-fighting substances called antibodies. Both mechanisms, antibody formation in the blood and changes in cells, probably interact to produce complete immunity to infection.

When the change in the nasal linings has once been induced, even after the resulting resistance has worn off and the animal is again susceptible to influenza, the nasal linings go through the change very rapidly when the next infection comes. These changes after the first one are so rapid that there are scarcely any symptoms of the infection that could be recognized as sickness.

Turning from ferrets to human beings, the Rockefeller scientists want first to find out whether such changes occur naturally in human nasal linings during colds or influenza. Two other important questions to be answered are: (1) Can these changes be induced artificially, so as to give immunity to these ailments? (2) Would it be good from the physiological standpoint to induce such changes or would they interfere too much with the normal function of the nose?

AGRICULTURAL AND FORESTRY RE- SEARCH IN LATIN-AMERICAN REPUBLICS

SCIENTIFIC research is being recruited to the aid of the U. S. Government's program of advancing its announced "good neighbor" policy in its relations with the other republics of this hemisphere to the status of mutual helpfulness among them, in the fields of agriculture and forestry.

Of the approximate million dollars designated for the promotion of closer cultural relations with our neighbors to the south, more than a third, or \$350,000, has been allotted to the Department of Agriculture, for the purpose of a long-range research program looking toward increasing the production in tropical America of raw materials needed in this country and now obtained principally from the Old World tropics. Some of the most important of these, notably rubber and quinine, actually originated in South America, but their present production is controlled by other countries in southeastern Asia and the East Indies.

Preliminary steps will be discussed at the Lima conference and in the meantime Department of Agriculture scientists are developing an agenda of projects to be undertaken. Expenditure of the \$350,000 breaks down into support of several lines of activity, all regarded as highly important:

For four new Department of Agriculture attachés, \$120,000 a year will be needed. At present this country has only one agricultural attaché in the entire Latin-American area, with an office in Buenos Aires. The new men will be located in Mexico City, Havana, Rio de Janeiro and Panama.

A survey of hardwood forest products of tropical American republics calls for \$65,000 a year. At present vir-

tually nothing is known about the economic possibilities of tropical American forests. A similar survey of soils, vegetation, climate and other factors affecting agriculture will take another \$65,000 a year. Rubber and quinine will receive special attention under this project. The sum of \$75,000 is set aside for the development of a tropical forest experiment station in Puerto Rico to work out problems and serve as a research center for the Caribbean region. The U. S. Weather Bureau will be given \$15,000 to make possible the training of meteorologists from American republics interested in special lines of weather forecasting technique. Particular attention to problems connected with hurricanes will be called for in this work. Finally, \$10,000 is made available for the printing of scientific bulletins and other publications after translation into the three languages of Latin America—Spanish, Portuguese and French.

Other lines of activity for which additional appropriations are not at present needed are the loan of agricultural officials to the American republics, cooperation with radio companies for the transmission of information and promotion of the early completion of the Inter-American Highway as far as Panama.

Although the whole subject is only now being formally broached, informal inquiries by representatives of certain other American republics indicate their keen interest, and even eagerness to cooperate by placing their scientific facilities and tracts of land at the disposal of the scientists, both American and from among their own nationals, who will take part in the work.—FRANK THONE.

ITEMS

CHEMISTS from seven Virginia colleges and universities have completed 180,000 tests on organic chemicals. The objective of the project is to find organic chemical reactions which are suitable for research in inorganic chemistry. More than 1,200 compounds have already been studied with 150 tests performed on each one. For each case a relationship is being sought between the molecular structure of the organic compound and its reaction. The project is under the supervision of Dr. John H. Yoe, professor of chemistry at the University of Virginia. Cooperating with him are: Drs. Lyle G. Overholser and Alfred Burger, of the university, and also A. R. Armstrong, of the College of William and Mary; Professor I. A. Updike, of Randolph-Macon College; Professor W. E. Trout, of Mary Baldwin College; Professor J. W. Watson and Professor F. H. Fish, of the Virginia Polytechnic Institute; L. J. Sesha and J. R. Taylor, of Washington and Lee University, and Professor W. J. Frierson, of Hampden-Sydney College.

WALLS filled with mineral wool can withstand flames and retard the spread of fire with considerably greater effectiveness than walls not so filled, according to tests conducted at the National Bureau of Standards. Walls filled with mineral wool resisted the penetration of test flames 10 to 30 minutes longer than walls without insulation of this kind. Rock, slag and glass wool were all tried. "The filling apparently retards the transmission of heat to the unexposed facing and decreases the rate of burning of the wood supports."

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ISIS

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of Science and of the History of
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edited by*

GEORGE SARTON, D.Sc.

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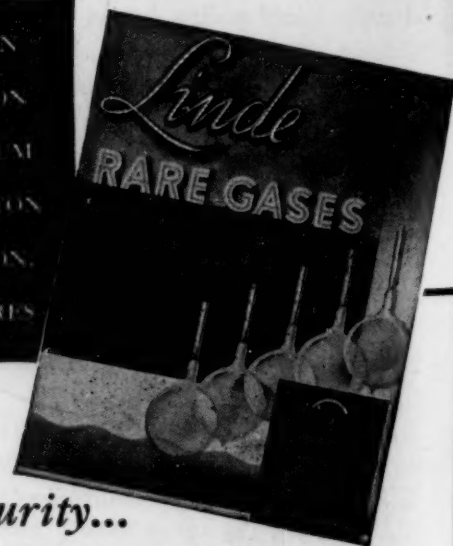
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SCIENCE NEWS

Science Service, Washington, D. C.

THE HEALTH RECORD OF THE UNITED STATES FOR 1938

A YEAR ago, in a similar statement for Science Service, I said that the health outlook for 1938 was altogether favorable. This prediction was based on the remarkable health record established for 1937 among the many millions of persons who were industrial policyholders of the Metropolitan Life Insurance Company. My optimism was more than justified, for no previous year has even closely approached the record for low mortality established for 1938. Month after month, the death rates among these insured wage-earners and their families have been even lower than during 1937, and at the middle of December we find a year-to-date death rate that is over 7 per cent. below the previous minimum, as established only a year since.

What happens among these many millions of people is a pretty sensitive index of health conditions in the country, as a whole. So, even if I had no other source of information I could say that 1938 has been an extraordinary health year in the United States. But, as a matter of fact, information for the first nine months of the year is available from the health officers of thirty-nine states. The story they tell is that without a single exception, every one of these states has shown improved mortality as compared with 1937—and in many instances very marked improvement. It is thus practically certain that 1938 will be acclaimed the banner health year in the history of our country.

The principal factors in bringing about this favorable situation were the much lower mortality rates this year from diseases affecting the respiratory system, namely, pulmonary tuberculosis, influenza and pneumonia, and the gratifying accomplishments of the campaign to reduce the shameful toll of automobile accidents.

The death rates from tuberculosis, pneumonia and influenza have reached new minima for the United States during 1938. It is almost certain that the mortality from tuberculosis for the country as a whole will drop below 50 per 100,000 for the first time in history. If the present rate of decline continues for a few more years tuberculosis will reach the stage where the number of open cases will no longer be sufficient to maintain it among the leading causes of death in this country. There has been no more striking instance of the success of the public health movement than the decline in the tuberculosis death rate during the last four decades. The time is now ripe for a final and intensified drive leading to the effective suppression of this disease.

There were no major epidemics of influenza or pneumonia in 1938. In the case of pneumonia, there was also the added factor, no doubt, of the wide adoption of the new serum treatment against the more prevalent types of pneumococcus. By placing these serums at the disposal of practising physicians, an increasing number of states are materially reducing the fatality rate in pneumonia cases.

Inasmuch as respiratory disease tends to hasten the deaths of persons suffering from cardiac, vascular or renal conditions, a natural consequence was the fall in mortality from most of the chronic diseases of old age. The sole exception to this rule, in 1938, was the continuance of the rise in deaths charged to coronary artery disease. But this increase may be only apparent, reflecting improved diagnosis together with the newly awakened interest of physicians in this form of heart disease and an increasing tendency on their part to give coronary disease prominence as the chief cause of death when associated with other conditions.

Among the most gratifying aspects of the mortality picture for 1938 was the marked decline in automobile fatalities. Evidently the very active crusade against careless driving which has been waged in all parts of the country in recent years is beginning to show results. Present figures indicate that the final tabulation will show fewer deaths by one fifth from this cause than were recorded in 1937 and this will mean about 8,000 lives saved. Fatal occupational accidents, as well as those occurring in public places, likewise resulted in fewer fatalities this year, although accidents in the home appear to have been as numerous as those reported a year ago.

Further gains against both infant and maternal mortality also contributed to the salutary state of public health during the past year. It is safe to report new minimal death rates in both of these important fields of public health work.

Aside from the rise in mortality from coronary artery disease, about the only disturbing feature of the present mortality picture is the continued increase of the cancer death rate. The year 1938 is the twentieth consecutive year, with a single exception, to register a rise in this malignant form of human affliction. There is some doubt, however, as to whether this upward trend in cancer deaths actually marks an increase of the disease or merely reflects the rapid aging of our population. Since cancer is a disease that is confined largely to the later years of life it is certain that much of the apparent rise is attributable to the increasing proportion of old people in the general population. Improved means of diagnosis and more accurate reporting also have been important elements in the apparent increase in cancer mortality.

Turning to the sickness side of the subject we find a gratifying situation also. All but two of the leading communicable diseases showed below-normal prevalence during 1938. The country was especially blessed in that it was comparatively free of that scourge of childhood, poliomyelitis (infantile paralysis). Less than 1,700 cases were recorded throughout the entire country and no section has suffered what might be called a major outbreak.

Only measles and smallpox were unusually prevalent during the current year. Fortunately neither of them was responsible for much mortality, although the exceptionally low death rate from measles in 1937 was probably quadrupled in 1938.—LOUIS I. DUBLIN.

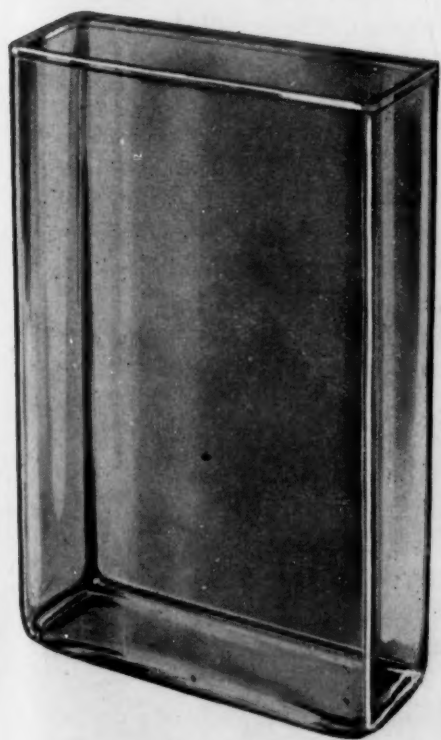


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THE GERMAN JEWS

THE problem of Jewish emigration from Germany is complicated not only by its magnitude but also by the fact that German Jews belong almost exclusively to the "middle class," are mostly city dwellers, and have an extraordinarily high proportion of old people.

Figures about the social-economic conditions of the Jews are only available for Germany (1933), but things were very similar in Austria. Of the 240,000 gainfully employed Jews 10 per cent. were in professional service, 40 per cent. were proprietors, managers and officials of all kinds, 10 per cent. family workers in the businesses of their parents or other relatives, 30 per cent. in clerical and kindred occupations and only 10 per cent. wage workers, mostly skilled operatives in the "handicraft trades" (tailors, butchers, etc.) Almost no Jews were engaged in agriculture.

The great majority of the German Jews are city dwellers and most of these city dwellers live in large communities with more than 100,000 inhabitants. At the last census, 71 per cent. of all Jews in the old Reich and 93 per cent. of those in Austria were enumerated in such cities. To-day the metropolitan proportion must be still higher because many Jews have been forced to leave their homes in the villages and small towns and have sought refuge in the large centers.

The age composition is highly abnormal. Nearly a third (31.6 per cent.) of all Jews in Germany were 50 years of age and over in 1933 as against 21.7 per cent. of the German people as a whole and 17.1 per cent. of the total population in the United States. Figures for Austria are not available. This condition has undoubtedly become more accentuated owing to the natural process of aging, a low birth rate and heavy emigration from the younger age groups.

At the time of the last censuses the total number of Jews was about 500,000 in the old Reich (1933) and 191,000 in Austria (1934). In addition there were about 4,000 Jews in the Saar Territory and more than 20,000 in the Sudetenland. The number of Jews had been decreasing for some time as a result of an excess of deaths over births and of emigration. Both factors have been operating at an increasing rate in recent years, but for obvious reasons the exact number of Jews in Germany to-day can not be given. It may be estimated to be rather less than 500,000. These figures do not include "Non-Aryans" according to Nazi doctrines who do not belong to the Jewish religious community. Their number is unknown but probably amounts to several hundred thousand.—CHRISTOPHER TIETZE.

THE UKRAINE

THE Ukraine, split into two parts by the Polish-Soviet frontier, is the granary of much of the U.S.S.R. The Russian portion particularly, which is by far the larger, is a region of growing industrial importance. From it comes coal out of the famous Donetz basin; in it are huge factories. On its River Dnieper sits mighty Dnieproges, second largest hydroelectric development in the world, a monument to the Russians who built it and the American engineer, Hugh S. Cooper, who designed it. Only Boulder Dam in Nevada is greater.

It was not always such a province, however. Its great cities like Kiev, many times have felt the iron heel of conquest. Almost 700 years ago Batu and his celebrated general, Sabutai Bahadur, whose campaigns still teach the world's soldiers the principles of strategy and tactics, reduced Kiev by assault. The inevitable massacre wiped out its inhabitants; the inevitable pillage and looting razed it to the ground.

Through the Ukraine these Tartars, sent by the son of the terrible genius, Genghis Khan, poured, to create havoc for decades in central Europe. Centuries earlier had come another Asiatic tribe, the Magyars, who to-day are the Hungarians. Their cavalry also devastated this region and caused no end of trouble in Europe until they finally settled down. Though no exact early records exist, no doubt through this gateway came still earlier hard-fighting barbarians.

Following the final partition of Poland among Austria, Prussia and Russia, between 1772 and 1795, the entire Ukraine region passed into the hands of the Tsars. It remained thus until the Tsars themselves were ousted in the February revolution of 1917. An independent rada or council took over the Ukrainian Government in June of that year.

In March, 1918, German troops under the command of General Eichorn invaded the Ukraine, ostensibly to assure delivery of food supplies which had been guaranteed to Germany in the separate peace treaty the Ukraine Government signed with Germany at Brest-Litovsk the year before. The rada was dissolved by the German troops and a Ukrainian, Skoropadski, was named by the Germans to head this government.

But General Eichorn was assassinated, the Ukrainians rebelled. Following internal strife between the Bolsheviks, who were then coming to the fore, and the "Whites," the Bolsheviks made themselves masters of the Ukraine. The German army, the nation that sent it into a state of collapse, was expelled. So were other invaders. The bulk of the Ukraine remained in the hands of the followers of Lenin.

The western part of the Ukraine was, however, retained by Poland. To-day its inhabitants number about 3,000,000, of whom most are Ukrainians, in whom the flame of Ukrainian nationalism still burns strong. Many attempts to stir up trouble both in the Polish and Soviet Ukraine are based on this factor.

The Ukrainian Soviet Socialist Republic, one of the autonomous soviet republics, on January 1, 1933, had a population of about 32,000,000, of whom the overwhelming majority are Ukrainians. Its people number 19 per cent. of the population of the U.S.S.R. Included within the area also is the small Moldavian Soviet Socialist Republic. Both have seen intensive development in recent years.

Besides being the richest grain area in Europe, the Ukraine is also the source of many important crops. Sugar beets, cotton, sunflower seed, forage and potatoes are all grown on a large scale. Cotton, of which 230,000 hectares were sown in 1937, is a crop introduced by the Bolsheviks, for none was grown there before they came to power. Other crops have been similarly expanded.

The most famous of the Ukraine enterprises is doubtless the Donetz coal basin, claimed to be one of the most

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modern in the world. In 1913, 22,800,000 long tons were mined; by 1936 the output had been pushed to nearly three times that figure, 68,300,000 long tons. Alexei Stakhanov, the introducer of rationalized production methods in the Soviet Union, was a Donetz miner. Other important Ukraine industries include iron and steel making, food packing and transportation. Its railway net is the densest in the U.S.S.R.

The Ukrainians themselves are a people who came out of Poland centuries ago to escape persecution in the old Polish-Lithuanian empire that existed prior to the partitioning. Their intense nationalism can probably be traced to this heritage, as well as to their suffering at the hands of the Russian Tsars, one of whose cardinal principles was the Russification of all non-Russian peoples within the empire.—LEONARD H. ENGEL.

THE THIRTY-FIFTH ANNIVERSARY OF BIRTH OF AVIATION

ALPHEUS W. DRINKWATER, the telegrapher who flashed a nine-word message to an unbelieving world on December 17, 1903, that the Wright brothers had successfully made the first airplane flight in history, was at his old post, tapping out the news, as aviation leaders gathered to mark the thirty-fifth anniversary of the birth of aviation.

But this time Mr. Drinkwater was more than the unbelieving telegrapher, for he is also head of the Kill Devil Hill, North Carolina, Memorial Association, in charge of the celebration. Two hundred planes roared overhead as Mr. Drinkwater and Army, Navy, Coast Guards and Marine Corps representatives placed wreaths on the memorial beacon in honor of the two brothers who gave the world wings.

After the ceremony, Mr. Drinkwater retired to his home in Manteo to send out the news reports from this isolated sand dune, Kill Devil Hill, down which the Wrights' plane skidded precariously to make the first successful take-off of a power-driven heavier-than-air craft.

Representing the Army Air Corps at the ceremony was General H. H. Arnold, its recently elevated commandant, while Assistant Secretary Charles Edison represented the Navy. Mail from a specially established Kill Devil Hill post office and bearing a special cancellation was sent out *via* air.

As a matter of historical record, Mr. Drinkwater recalled that the telegraph message, which startled the world and gave the skeptics of that day some short-lived innings, was sandwiched in between wires of news at Kitty Hawk that appeared much more important at the moment.

That news, now forgotten, concerned the beaching of Uncle Sam's first submarine. Mr. Drinkwater, who had set his key on an orange crate on the beach, was wiring news of this wonder, which attracted all the attention from the local citizenry, to President Theodore Roosevelt, who was keenly interested.

But while no one remembers the submarine, no one has forgotten the Wrights.

ITEMS

TERMITES have chewed wood, apparently, ever since

there has been any wood to chew. New evidence on this point has been found by Professor Austin F. Rogers, of Stanford University, in a piece of opalized wood from Santa Barbara County. Areas of the wood tissue had been eaten away and the spaces thus left were packed with petrified pellets of the size and shape left by the tunneling operations of termites. The specimen is of pliocene geologic date, which gives it an age of perhaps ten million years.

ALL the laws in the world can not create industrial health, V. P. Ahearn, of the National Industrial Sand Association, told a meeting of the Air Hygiene Foundation in Pittsburgh. Improved health for the worker can only come when industrial management takes an interest in the problem and actively supports research to learn the ways in which industrial health can be achieved. Promoting industrial hygiene, Mr. Ahearn said, is the newest task of industry, if it is forward-looking, it will not stand content on its older idea that its function was to earn profits and provide labor—in so far as it was able—with steady jobs at fair wages. There is a definite trend, Mr. Ahearn indicated, toward legislation in the industrial health field. It can only be sound legislation if it is based on research in industrial hygiene promoted by industry as a whole.

STUDIES by investigators at the U. S. Bureau of Mines are disclosing the causes of disastrous boiler explosions which create \$700,000 worth of damage to stationary and locomotive boilers each year. In a lecture on November 22, at the University of Maryland, Dr. W. C. Schroeder described how intercrystalline cracking penetrates through the boiler wall, forming cracks, in some cases, before they become visible. Causes of the cracking, Dr. Schroeder pointed out, include the concentration of boiler water as much as 1,000 times. Ordinary water, not concentrated, does not cause the cracks. This concentrated water will cause the cracking only if a peculiar balance is achieved between corrosive and protective properties. It seems necessary—as a cause of the cracking—that the grain face be protected but the grain boundaries should be exposed.

JAPAN is undertaking the exploitation of aluminum ores discovered in Manchuria, according to *Industrial and Engineering Chemistry*, official journal of the American Chemical Society, published in Washington. The Manchurian ores are high in phosphorus content and so must first be refined by a process credited to investigators at the University of Tokyo. The ore is treated with sulfuric acid, yielding phosphoric acid and aluminum sulfate. The latter is treated with gaseous ammonia at 1,200 degrees Centigrade. Out of the reaction comes ammonium sulfate and aluminum oxide. The reduction of the aluminum oxide to metallic aluminum is accomplished by standard electrolytic methods. Plans for the development call for the treatment of 15,000 tons of ore annually from which will be obtained 5,100 tons of metallic aluminum (about 11,000,000 pounds). American aluminum production, in contrast, is nearly 300,000,000 pounds a year.

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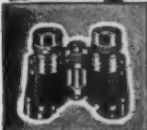
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SCIENCE NEWS

Science Service, Washington, D. C.

THE FLUIDITY OF HELIUM

THE stature of Professor Albert Einstein's genius reached new heights when it was disclosed that the learned mathematical physicist developed mathematics fifteen years ago which are now helping to solve the mysteries of the amazing fluidity of helium near the absolute zero of the temperature scale. Before the symposium on intermolecular action of the American Chemical Society Professor F. London, of the University of Paris, now visiting professor at Duke University, credited Professor Einstein with the concept of an "ideal" gas which appeared in papers published in 1924 and 1925.

The Einstein 1925 reports were not about relativity theory, but discussed problems seemingly without any practical significance at the time. They described the degeneracy of an "ideal" gas near the lower limits of the scale of temperature. Because all gases were known to be condensed to liquids at the temperatures in question, scientists rather overlooked the Einstein work of fifteen years ago.

However, the recently discovered behavior of liquid helium has brought the side-tracked Einstein concept to new usefulness. Most liquids increase in viscosity, become stickier and flow less easily, when they become colder. The phrase, "colder than molasses in January" is the layman's concept of viscosity and a correct one.

Liquid helium, however, is a baffling exception. At the temperature known as the "delta" point, only 2.19 degrees above absolute zero, liquid helium flows better than it does at higher temperatures and, as a matter of fact, the liquid helium is about as nebulous as a gas. Added puzzles in its strange behavior include its enormous ability to conduct heat. At the delta point it is about 500 times as effective in this respect as copper at room temperature. Liquid helium, with these and other anomalies, has posed a major mystery for physicists and chemists.

Professor London stated that the interpretation of the behavior of liquid helium can best be explained by considering it as a Bose-Einstein "ideal" gas, by using the mathematics worked out in 1924-25, and by taking over also some of the concepts of the electrical conduction of metals. By simple analogy, the amazing fluidity of liquid helium can be partially explained by picturing the fluidity as something akin to the wandering of electrons in metals to explain electrical conduction.

THE ENERGY OF COSMIC RAYS

DECEMBER 28 was cosmic ray day at the meetings in Washington of the American Physical Society and leading experts in the studies of these piercing, baffling radiations from outer space reported:

1. Cosmic ray electrons entering the earth's atmosphere have energies greater than 2,000,000,000 electron volts.

2. The development of automatic apparatus to record the "showers" of atomic debris caused by cosmic rays striking materials on earth.

3. Improved apparatus for determining cosmic ray intensities high in the atmosphere during robot stratosphere balloon flights has been developed.

4. No observed difference between day and night cosmic ray intensity at high altitudes.

5. Measurements of the "life" of the heavy electron (mesotron) particles that show they last only a few millionths of a second.

Professor R. A. Millikan and Dr. H. V. Neher, of the California Institute of Technology, reported the results of 10 new balloon flights almost to the top of the earth's atmosphere which give a lower limit of energy for cosmic ray electrons as 2,000,000,000 electron volts.

The automatic "shower" records were described by Dr. W. F. G. Swann and Dr. W. E. Ramsay, of the Bartol Research Foundation of the Franklin Institute, while Drs. L. F. Curtiss, A. V. Astin, L. L. Stockmann and B. W. Brown, of the National Bureau of Standards, told of their improved recording circuits devised for studies of cosmic ray intensities at high altitudes.

In papers with Drs. S. A. Korff and M. A. Pomerantz, Dr. Thomas H. Johnson, assistant director of the Bartol Research Foundation, described high altitude attempts to find a night-day difference in cosmic ray intensity and experiments on the absorption of the mesotron particles in air and lead which indicate new estimates of the "life" of these new-found atomic particles.

ROBERT D. POTTER

ENERGY PRODUCTION IN STARS

CARBON, so vital to life on earth, is now revealed as the transmuting catalyst in the sun which makes it possible for hydrogen atoms to combine into helium and thus release the vast store of nuclear energy which makes the sun shine on and on through the ages.

The Morrison Prize of \$500 to Professor Hans A. Bethe, of Cornell University, for the theory which produces this picture of the cause of solar energy brings public recognition to something which scientists have known for some time.

The details are ingenious and important. Carbon atoms are transmuted by swift-moving hydrogen nuclei into nitrogen. These nitrogen atoms are again struck by hydrogen particles and eventually create helium atoms and regenerate carbon atoms with the release of enormous energy. It is the hydrogen on the sun which is used up in the process, while the carbon content of the sun remains pretty much the same.

But many people will leave the intricate details of the process to the scientists and jump mentally onward to a most important question for all of man's descendants on earth in the millions of years to come.

That question is, "What happens to the sun and to the earth as the sun goes on using up its hydrogen to create the solar energy?" And the answer is one of flaming death for the earth, as contrasted with former pictures of the earth becoming colder and colder as the sun's energy diminishes. True, the sun probably will become

a cold body and hence the earth, too, will sink into an ultimate frozen state, which is known already to have overtaken other stellar objects. But before that day comes, the sun is going to become much hotter than it now is and life on earth, as man knows it, will probably end. That forecast of the end of the world is an outgrowth of the theory of Professor Bethe on the transmutation of hydrogen into helium on the sun as the cause of solar heat and radiant energy.

Professor George Gamow, at George Washington University, ten years ago worked out the theory of nuclear transformations which made it possible to calculate exactly the rate of energy liberation due to the transformation of the elements at the enormous temperatures of several million degrees existing inside stars and particularly inside the sun. In recent work he has extended his studies to include the evolution of stars as they transmute their hydrogen into helium atoms. The main result of the constantly decreasing hydrogen content, it is pointed out, is to increase the luminosity of such stars and to increase their outpouring of energy. Professor Gamow estimates that the sun at the present time consists of about 60 per cent. hydrogen. Most important, the sun is bound to become about 100 times brighter than it is at present when its hydrogen content drops only a few per cent. "Such brightening of the sun will necessarily lead to the melting of the earth and, of course, to the disappearance of life," he stated in a recent lecture.

This then, at the present time, is the best concept of the end of the world. But before alarms need be raised by present occupants of the earth it should be added that while the sun may be getting hotter it is doing so most slowly as measured by man's calendar. It is believed that there has been no observable climatic change in historical time due to an increase in the luminosity of the sun. Hence the end of the world, from this cause at least, is millions upon millions of years in the future.

ICE AGE HISTORY OF THE EARTH

BETTER knowledge of the Ice Age history of the earth is obtainable from a great chart of the ocean bottom off the eastern coast of the United States, from Chesapeake Bay to Cape Cod, prepared for the annual meeting of the Geological Society of America meeting in New York City by A. C. Veatch, consulting geologist of New York City, and Lieutenant Paul A. Smith, of the U. S. Coast and Geodetic Survey.

This chart was made for special geological study, under the auspices of the Geological Society of America, from surveys conducted by the U. S. Coast and Geodetic Survey, under the direction of Rear-Admiral L. O. Colbert, for use in practical navigation. The chart, which is on the large scale of 1 to 120,000, was compiled from many thousands of echo soundings of the bottom, and show the submerged hills and valleys, plains and canyons, as clearly as any topographic maps of the land. They give the first really detailed picture of a large piece of sea floor that scientists have ever had a chance to inspect as a whole. Four large sheets were shown to the geologists; the fifth,

which will complete the chart, is now being finished in Washington. Geological interpretations of the off-shore topography were made by Mr. Veatch, who was seriously ill as the society met and who died before the meeting. The paper was presented in his absence by Lieutenant Smith. Among Mr. Veatch's conclusions are these:

(1) The off-shore canyons of which so much has been heard are only conspicuous features in a submarine landscape which is "finely dissected" into many smaller valleys, ridges and hills along the coastal slope.

(2) The coastal shelf, behind the slope, is a smooth, comparatively flat submerged plain.

(3) The notable canyons cut back into this plain, and one of them, the Hudson, has been definitely connected to a land valley.

(4) Besides the Hudson Canyon, there is a submerged Hudson Channel, which is shallow and flat bottomed, with a width of about ten miles, at a depth of 35 fathoms (210 feet). At the 43-fathom level this wide channel shows a delta formation, and this is taken by Mr. Veatch as a definite measurement of a long-continued earlier stage in the sea level.

The lowest level which the sea ever reached, as measured by these submarine canyons, is represented by the Congo Canyon off the coast of Africa, which shows an extreme depression to 12,000 feet below present sea level. Cutting of this canyon, according to Mr. Veatch, began in post-Mousterian (Old Stone Age) time, and the ocean did not finally return to its present level until 5,000 years ago, or after the beginning of written history.

Present-day practical uses of this detailed chart will include guiding ships by means of echo soundings when fog or darkness blot out all other navigation marks. Navigators will be able to "see" a transect of the bottom beneath their ship as clearly as aviators do a mountain landscape under bright sunlight.

RACIAL PSYCHOLOGY

STATING that no conclusive evidence has been found for racial or national differences in either intelligence or personality, psychologists have issued an official protest against the "non-scientific interpretations" of racial psychology which "Fascists are using to justify persecution." These theories have been developed, they said, not on basis of fact but under domination of powerful emotion. Prepared by psychologists who are specialists on racial psychology after a survey of scientific investigations in this field, the protest was issued officially by the Council of the Society for the Psychological Study of Social Issues.

Members of the council are: Dr. F. H. Allport, Syracuse University, Dr. Gordon Allport, Harvard University, Dr. J. F. Brown, University of Kansas, Dr. Hadley Cantrel, Princeton University, Dr. L. W. Doob, Yale University, Dr. H. B. English, Ohio State University, Dr. Franklin Fearing, University of California, L.A., Dr. George W. Hartmann, Columbia University, Dr. I. Krechevsky, University of Colorado, Dr. Gardner Murphy, Columbia University, Dr. T. C. Schneirla, New York University, and Dr. E. C. Tolman, University of California.

TEXT OF THE PROTEST

The current emphasis upon "racial differences" in Germany and Italy, and the indications that such an emphasis may be on the increase in the United States and elsewhere, make it important to know what psychologists and other social scientists have to say in this connection.

The fascists and many others have grossly misused the term "race." According to anthropologists, the term "race" may legitimately be used only for such groups as possess in common certain physical or bodily characteristics which distinguish them from other groups. It is impossible to speak correctly of a "German race" or of an "Italian race," since both of these groups have highly diversified physical characteristics.

A South German may resemble a Frenchman from Auvergne or an Italian from Piedmont more closely than he does a German from Hanover. North Italians are markedly dissimilar from those living in Sicily or Naples.

More important still, the emphasis on the existence of an "Aryan race" has no scientific basis, since the word "Aryan" refers to a family of languages and not at all to race or to physical appearance.

As far as the Jews are concerned, scientific investigations have shown them to be tall or short, blond or dark, round-headed or long-headed, according to the particular community studied. In the light of this wide variation in physical characteristics, almost all anthropologists outside of Germany and Italy would agree that it is scientifically impossible to speak of a "Jewish race," much less of an "Aryan race."

In the experiments which psychologists have made upon different peoples, no characteristic, inherent psychological differences which fundamentally distinguish so-called "races" have been disclosed. This statement is supported by the careful surveys of these experiments in such books as "Race Psychology" by Professor T. R. Garth, of the University of Denver; "Individual Differences," by Professor Frank S. Freeman, of Cornell University; "Race Differences," by Professor Otto Klineberg, of Columbia University, and "Differential Psychology," by Dr. Anne Anastasi, of Barnard College.

There is no evidence for the existence of an inborn Jewish or German or Italian mentality. Furthermore, there is no indication that the members of any group are rendered incapable by their biological heredity of completely acquiring the culture of the community in which they live. This is true not only of the Jews in Germany, but also of groups that actually are physically different from one another. The Nazi theory that people must be related by blood in order to participate in the same cultural or intellectual heritage has absolutely no support from scientific findings.

MARJORIE VAN DE WATER

ITEMS

EVIDENCE that during the Ice Age the water off the northern Atlantic coast of what is now the United States was Arctic in character is given by Dr. Fred C. Phleger, Sheldon traveling fellow in geology. Dr. Phleger examined cores of sea bottom sediment collected by Dr.

Henry C. Stetson, of Harvard University. In them he found shells of the one-celled animals known as Foraminifera, very similar to species that now drift in the waters of the Arctic Ocean.

THE great New England hurricane last fall did enormous damage to bathing beaches along the coast of southern New England, yet much of the damage is already being healed by natural processes, according to the report of Drs. Robert L. Nichols and Lawrence Goldthwait, of Tufts College. Some of the beaches will be in condition for use as early as next summer, although others will require longer for natural repairs. The great damage done by the hurricane was due principally to the piling up of tremendous masses of water, when the 150-mile off-shore wind happened to coincide with the period of normal high tide. The wind caused the water to rise from 10 to 15 feet higher than the usual high tide mark.

DEFORMITIES in children should be corrected at the earliest date possible—a few within the first week of life and all before the child reaches school age. Calling on the medical profession to realize the severe mental reactions and the personality changes that result from uncorrected deformities, Drs. Claire L. Straith and E. Hoyt De Kleine, Detroit surgeons, report on plastic surgery in childhood in the *Journal of the American Medical Association*. Inferiority and shame, peculiar personality traits and anti-social tendencies are likely to develop as the result of such deformities as facial birthmarks, saddle nose, hunchback, crossed eyes, lop ears, disfiguring scars, harelip and cleft palate.

THE U. S. Public Health Service reports that two out of every thousand college students in the United States are infected with syphilis. The figure was arrived at by blood tests of 78,388 undergraduates in more than 500 American colleges made in a study by staff members of the service for the American Social Hygiene Association. The significance of the findings lies in the fact that efforts to control syphilis in the nation must, to be effective, begin with individuals in the age-group of first exposure to the infection. Control in this age-group, of which college students form an important section, offers real and perhaps the only hope that the general syphilis rate can be materially reduced.

PIGS on a too-exclusive diet of corn get a disease resembling the pellagra to which humans on the same kind of diet become victims, and they can be cured with the same substance, nicotinic acid. This has been demonstrated in experiments at the Lister Institute, London, and at the Institute for Animal Pathology in Cambridge, by Dr. Harriette Chick, Sir Charles Martin and a group of collaborators. Young pigs kept on a "straight" corn ration for three or four months were almost at the point of death, with all the repulsive symptoms of advanced pellagra, when they were given injections of nicotinic acid. Recovery began within twenty-four hours, and within six weeks normal health and appetite had been restored.

PREVIEW OF THE ANNUAL EXHIBITION

The American Association for the Advancement of Science, The Mosque, Richmond, Virginia,
December 27 to December 30

The exhibition of the American Association for the Advancement of Science will this year be held at the Mosque, Richmond, Va., Dec. 27-30. Exhibits sponsored by the Association are limited to the following categories:

- (1) Exhibits that illustrate scientific studies, phenomena or progress.
- (2) Exhibits of apparatus, methods or materials that are useful in scientific instruction and research.
- (3) Exhibits of publications that are of value in the dissemination or advancement of knowledge in science.
- (4) Exhibits that are of value as aids in education or research in science.

We wish to express our appreciation for the cooperation that we have received from the exhibitors who, by their understanding of the above categories, have helped to maintain the high standards of the exhibition. A brief description of each exhibit follows. OWEN CATTELL

AMERICAN INSTRUMENT COMPANY Silver Spring, Md. Booth No. 54

Features of the exhibit of the American Instrument Company will be precision absorption cells, neutral wedge photometers, photoelectric photometers, thermoregulators, electric heaters (immersion, room, space, etc.), portable cooling units for constant temperature baths, etc., Barcroft-Warburg respiration apparatus, pH meters, circulating pumps, variable voltage transformers, constant temperature baths, etc. Mr. W. H. Reynolds and Mr. L. Heiss will be in attendance.

AMERICAN TOBACCO COMPANY Richmond Booth No. 6

The American Tobacco Company presents the most recent development in its automatic Smoking Machine, including the technic used in securing a representative smoke sample. There will also be shown representative samples from various stages of manufacture and other exhibits illustrating the application and results of scientific control in cigarette manufacture. Mr. J. A. Bradford will be in attendance.

BAKELITE CORPORATION Research and Development Division, Bloomfield, N. J. Booth No. 24

Plastics in the World of Science. The Bakelite Corporation exhibit will feature a number of interesting applications of Bakelite plastics in the world of science. The central feature of the exhibit will be an illuminated board demonstrating the origin of synthetic resins. This chart reduces to the simplest terms what would ordinarily be a most complex presentation. Bakelite polystyrene, urea, cellulose acetate and phenolic resins will be high spotted. Dr. H. L. Bender and Mr. R. W. Matthews will be in charge.

BAUSCH AND LOMB OPTICAL COMPANY Rochester, N. Y. Booth No. 33

The display of the Bausch and Lomb Optical Co. will give visitors an opportunity to see and have demonstrated

many of the optical instruments made by them. Research and Laboratory microscopes, microtomes, photomicrographic equipment, micro projectors, Balopticons and many other instruments will be set up for operation. Our representatives in attendance at the booth, Mr. G. H. Leffler, Dr. Max Poser and Mr. G. Rohde, will be glad to discuss your optical problems.

BIOLOGICAL ABSTRACTS University of Pennsylvania Booth No. 2

An abstracting and indexing service which enables the busy scientist and research worker to keep up with the ever-mounting current biological literature. The articles abstracted are from more than 700 journals published in 18 languages throughout the world. The display features the new sectional plan of publication, beginning in 1939, which will enable the scientist to subscribe to the section covering his specific field of interest. Dr. John E. Flynn, Editor, Dr. Jean MacCreight, Assistant Editor, Miss R. J. Feldman, and Mr. Pierce W. Anthony, Business Manager, will be present to explain the new plan and point out the time-saving usefulness of this service to science.

DR. ALBERT F. BLAKESLEE Carnegie Institution of Washington Cold Spring Harbor, N. Y. Booth No. 75

Differences between People in Taste Reactions. People differ in respect to the lowest concentration at which they can taste a given substance. The reactions to one substance at least (P.T.C.) have been found to be innate and inherited. The exhibit features a test of reactions to tablets of a rare sugar—mannose. Preliminary tests indicate that different people get different kinds of tastes from this sugar. Visitors are requested to register their taste reactions on a voting machine. The records, which will be posted daily, are part of a research program. It is hoped they may furnish valuable information regarding a major sample of the population. Dr. Blakeslee will be present at the exhibit.

P. BLAKISTON'S SON AND COMPANY, INC.
Philadelphia
Booth No. 21

In Booth No. 21 the Blakiston Publishing Company will exhibit a comprehensive collection of texts and references in the sciences and in medicine. This exhibit will feature the 1938 publications in Physics, Chemistry, Zoology, Botany, Physiology, Histology and Medical Science. As an added feature, advance information and proof will be available on six books to be published in January, 1939. Mr. Robert F. Bowman, Mr. E. R. Stetson and Mr. J. Brooks Stewart will be in attendance.

BOYCE THOMPSON INSTITUTE FOR PLANT RESEARCH, INC.
Yonkers, N. Y.
Booth No. 74

Exhibit of P. W. Zimmerman and A. E. Hitchcock

Work on growth substances at the Boyce Thompson Institute will be illustrated by means of green plants responding to treatment and pictures of results in the laboratory. The exhibit will be limited to methods developed and results obtained at the Boyce Thompson Institute. Time-lapse motion pictures will be shown at intervals to illustrate methods and actual responses. Typical exhibits are as follows: (1) Typical responses induced on plants by growth substances; (2) the tomato plant as a test object for comparative effectiveness of different substances; (3) practical applications: a. propagation of plants; b. methods suitable for laboratory demonstration; (4) natural growth substances and identification of applied growth substances.

CARNEGIE INSTITUTION OF WASHINGTON
Cold Spring Harbor, N. Y.
Booth Nos. 37, 38

Exhibit of Oscar Riddle and Robert W. Bates. "Prolactin, a hormone of the anterior pituitary gland" is described graphically, objectively and with transparencies and movie film on six panels, each $8\frac{1}{2} \times 4$ feet. The part played by this hormone in several vital processes, the principles of the method of separating it from other active pituitary substances, and also chief relationships of prolactin to the total functions of the pituitary gland are thus shown. The film records the induction of maternal behavior in virgin rats by injections of prolactin. Brain and pituitary gland are indicated as the two main sources of the abilities of higher animals and man.

CARNEGIE INSTITUTION OF WASHINGTON
Department of Terrestrial Magnetism, Washington
Booth No. 77

Model of Atomic Physics Observatory. This one twelfth size model shows the recently completed Atomic Physics Observatory constructed on the grounds of the Department of Terrestrial Magnetism at Washington, D. C. The steel pressure-tank, represented in the model by the transparent Plexiglas shell, is 55 feet high, 37.5 feet in diameter. Improved electrical insulation is effected by dry air compressed to 50 pounds per square inch, permitting a controlled working potential of from $\frac{1}{2}$ to over 5 million volts.

The electrode near the top of the tank is a 5-ton steel ball, 19 feet in diameter, supported on porcelain insulating columns. This electrode is raised to high voltage by electric charges conveyed from the base of the tank on a belt of rubber and fabric. Hydrogen or helium particles are produced by a glow discharge at the top of the high-vacuum tube and are accelerated down the tube by the high voltage, striking the targets with velocities as great as one tenth the velocity of light and producing atomic transmutations. A prime objective of the new equipment is the extension of the department's measurements, using its 1-million-volt equipment, on the forces which govern the atomic nucleus. Dr. G. W. Morey will be in attendance.

CLAY-ADAMS COMPANY
New York
Booth No. 28

The Clay-Adams Company will exhibit a series of circulatory models, also other models, charts and preparations of interest to biologists, psychologists and other members of the association. The pressed paper models, free from plaster of paris, or plaster of paris composition, will also be featured.

DISTILLATION PRODUCTS, INC.
Rochester, N. Y.
Booth No. 49

Distillation Products, Inc., an organization recently formed by the Eastman Kodak Company and General Mills, Inc., is now engaged in the manufacture and sale of molecular distillation apparatus, high vacuum pumps and other aids to high vacuum technology. A small cyclic batch still complete with the necessary pumps and other equipment can be seen in operation. Several types of glass fractionating diffusion pumps will also be on display. These units operate with newly developed fluids, and phenomenally low pressures—less than 5×10^{-8} —can be attained without the aid of any cold trap. The properties of a Vitamin A concentrate prepared by commercial molecular distillation methods will be shown.

DUKE UNIVERSITY, IN COOPERATION WITH THE VIRGINIA AGRICULTURAL EXPERIMENT STATION

Booth No. 36

Exhibit: Downy mildew of tobacco and its control. Materials: Specimens of living infected seedlings and herbarium specimens of infected leaves. Microscopic mounts showing microscopic appearance of *Peronospora tabacina* and *P. nicotianae*. Small seed beds with living tobacco seedlings showing type of construction and arrangement required for fumigation with benzol. Apparatus for measuring benzol-vapor concentration, spore traps and applicators for evaporation of benzol. Photographs showing symptoms and effects of the disease, structure of *Peronospora tabacina*, influence of moisture, temperature, porosity of covers, etc., on efficacy of fumigation with benzol. In attendance will be Dr. F. A. Wolf.

EASTMAN KODAK COMPANY

Rochester, N. Y.

Booth No. 51

A beautiful and fascinating exhibit of Kodachrome, the direct color transparency film, featuring this material in the new professional film sizes up to 8×10 inches. There will also be a display of miniature Kodachrome transparencies taken from a great many applications. The steps in the manufacture of the Kodak Anastigmat EKtar f/2 lens, used on the Kodak Bantam Special, interestingly displayed. New miniature cameras, an enlarger for making big prints from 16-mm movie film, and a movie viewer which shows movies in action while they are being edited. In attendance will be Mr. H. J. Christy and D. R. Farmer.

FORD MOTOR COMPANY

Detroit

Booth No. 29

This exhibit will be in three parts: Part 1 consists of paintings showing the history of the measurement of length and several of Mr. C. E. Johansson's first measuring instruments used in 1896 to 1903; Part 2, sets and individual Johansson gage blocks and accessories showing some uses of same; Part 3, motion picture of Rouge plant of Ford Motor Company, showing processes of iron ore coming into the plant and being taken away a few hours later as a complete car. Mr. O. E. Green and Mr. O. Kelley will be at the booth.

FOREST SERVICE

U. S. Department of Agriculture, Washington

Booth No. 5

The exhibit of the Forest Service, U. S. Department of Agriculture, attempts to present several major problems of forestry and human welfare. A map in colors shows the location and relative size of the National Forests and Purchase Unit. It was designed to bring out graphically, that, of the total remaining forest area within the United States—some 500 million acres—the National Forests and Purchase Units comprise 175 million acres or 35 per cent. Typical methods are exhibited by which the Forest Service "seeks to promote the best use, in the public interest, of all forest land and forest products in the United States." Fire prevention is stressed as a pressing public duty, inasmuch as approximately 91 per cent. of all forest fires in the United States are caused by man. Educational measures for informing the public in ways of forest conservation are featured.

THE GENERAL BIOLOGICAL SUPPLY HOUSE, INC.

Chicago

Booth No. 32

The General Biological Supply House, Incorporated, demonstrates for the first time its complete series of twelve colored zoology charts. The subjects are original, all steps in processing them were gone through in Chicago and their scientific accuracy has been passed upon by leading zoologists. The special soilless plant culture outfit is shown as it is used in biology laboratories. Throughout the entire display emphasis is placed upon *living* materials, although representative items from other phases of the business are on display. The Turtlox

representatives will welcome the opportunity of explaining all their many new teaching materials for the biological sciences. Mr. A. S. Windsor and Mr. John F. Longergan will be present.

GRADWOHL SCHOOL OF LABORATORY TECHNIQUE

St. Louis

Booth No. 8

This exhibit will show some of the recent methods of laboratory examinations illustrative of the teaching methods used at this school. Particular attention is called to the specimens of parasites, both eggs and worms. Methods of concentration of stools, etc., for the examination of eggs of parasites will be shown. Dr. R. B. H. Gradwohl and Mr. and Mrs. L. Erskine will be present.

INSTITUTUM DIVI THOMAE

Cincinnati

Booth Nos. 3, 4

Researches at this institute indicate that living cells produce hormone-like chemical factors ("intercellular hormones" or "biodynes") which control the respiration, glycolysis and proliferation of the cell community. The effects of the respiratory stimulating factors will be demonstrated, the production of proliferation promoting factors ("wound hormones") by injured cells illustrated, and the relationship of these researches to the investigation of the cancer problem outlined. Dr. John R. Loofbourow will be in attendance.

CHAS. T. KNIPP

University of Illinois

Booth No. 11

Experiments in Modern Physics: (1) Active nitrogen, 50 liter bulb. Also afterglow in various other gases. (2) Molecular bombardment, illustrating Boltzmann's law of distributed velocities. Two tubes operated simultaneously. (3) Singing tubes—the production of sound by temperature differences. For example, a tube ordinarily operated by heating the tip (Knipp's singing tube) will emit a much lower tone when the tip is kept at room temperature and the rest of it cooled to the temperature of liquid air. Other striking and weird experiments may be performed with these tubes. The above three experiments illustrate phenomena in three distinct fields of physics. They are interesting and instructive. They hold the attention because they are unusual and yet simple. They may be viewed at a distance.

LEANDER McCORMICK OBSERVATORY

University of Virginia

Booth No. 76

The chief instrument is the 26-inch visual refractor, at one time the largest telescope in the world. The exhibit shows the progress of astronomical research in the following fields: (1) The distances or trigonometric parallaxes of 1,350 stars. (2) Motions of 18,000 faint stars (finished) and 12,000 additional stars (in progress) giving knowledge of solar motion, galactic rotation, stellar distribution. (3) Variable motions (invisible companions of stars). (4) Double stars, real and artificial. (5) Brightnesses or magnitudes of 8,000 stars in sequences for long-period variables. (6) Stellar photometry. (7) Spec-

tral classification of faint stars. (8) Total eclipses of the sun. Dr. S. A. Mitchell will be in charge.

LEEDS AND NORTHRUP COMPANY
Philadelphia

Booth No. 50

Exhibit includes: Universal pH indicator—a compact and completely self-contained instrument which measures directly in pH units with electrodes following the Nernst equation and which measures in voltage with any electrode: Improved portable potentiometer for antimony, quinhydrone or hydrogen electrodes: Type K potentiometer—the versatile general-purpose instrument for precise potential measurements: Thermionic amplifier for adapting potentiometers to glass electrode measurements: Speedomax recorder of improved design which records at about ten times the speed of the ordinary industrial pyrometer: One-ohm resistance standard which establishes a new order of stability in resistance standards: Dropping mercury electrode recording equipment (including Micromax strip-chart recorder) for laboratory determinations of the composition of solutions. Mr. C. E. Applegate and Mr. E. D. Moiles, Jr., will be in attendance.

E. LEITZ, INC.
New York

Booth No. 9

E. Leitz, Inc., are exhibiting the latest microscopical and photomicrographic equipment as well as microscope accessories and Leica Cameras. The new Leitz Research Microscope ORTHOLUX is the most advanced design incorporating many features of outstanding importance. The Universal Microscope and photomicrographic apparatus PANPHOT is of most recent design permitting investigations in any kind of illuminations so far available for microscopic study. Photomicrography in natural colors which is made possible with Leitz Rollfilm Camera Attachment available for use with any kind of microscope. A new type Leitz automatic continuous projection attachment available for use with standard Leitz Leica Projectors—the ideal projection equipment for lectures. Also a variety of microscopical accessories and accessories for Leica Cameras. Messrs. F. P. Mulgannon and E. Keller will be present.

THE LINGUAPHONE INSTITUTE

New York

Booth No. 1

The Linguaphone display at the Richmond Exhibit offers visitors something unique in a subject in which all of them are interested—language. Linguaphone is a simplified method which takes all the “kinks” out of learning a foreign language. By reducing grammatical memorization to a minimum, this direct conversational method really makes it possible for the student to acquire fluent conversation in a reasonably short time and an ability to read and write in a much shorter period. Linguaphone courses are available in 27 languages, including all the important European languages as well as Chinese, Japanese and some other Oriental tongues. Mr. Max Sherover, president of the Linguaphone Institute, as well as his son, Charles Sherover, will greet visitors to the exhibit.

THE MACMILLAN COMPANY

New York

Booth Nos. 52, 53

The book exhibit sponsored by The Macmillan Company is again a spacious and attractive one. Approximately seven hundred and fifty volumes—undergraduate and graduate text-books, reference books and technical and scientific books designed for the general reader, including numerous juvenile titles—are displayed and arranged conveniently for examination. The following classifications are represented: Agriculture, the Biological Sciences, Chemistry, Engineering, History of Science, Home Economics, Mathematics, Medical Science and Physics.

McGRAW-HILL BOOK COMPANY

New York

Booth No. 22

Advanced proofs of important forthcoming books in the field of science will be on display at the McGraw-Hill booth. You are invited to see at this booth also an exhibit of recent McGraw-Hill books in the field of Agriculture, Astronomy, Biology, Chemistry, Education, Forestry, Geography, Geology, Mathematics, Metallurgy, Physics and Psychology. Mr. C. G. Benjamin, Mr. S. Everett Field and Mr. N. R. Beers will be at the exhibit.

MERCK AND CO., INC.

Rahway, N. J.

Booth Nos. 57, 58

The exhibit of Merck and Co., Inc., Rahway, N. J., is devoted to a scientific presentation of the chemistry of vitamin B₁ hydrochloride. A large central panel with a photomontage background of various operations in the study, synthesis and manufacture of vitamin B₁ has superimposed on it stereochemical models showing the complete detailed synthesis of the vitamin, according to the procedure of Williams and Cline. Side panels illustrate the gradual unravelling of the intricate problem of the nature of the constituents of the vitamin B complex and the present-day conception of the structure and function of the enzyme, cocarboxylase. Dr. C. R. Addinall will represent the company.

THE C. V. MOSBY COMPANY

St. Louis

Booth No. 12

Members of the teaching profession will find at Booth Number 12 text-books on many phases of the biological sciences. These books cover the subjects of Anatomy, Physiology, Hygiene, Psychology, Zoology, Biology, Bacteriology, Chemistry, Public Health, Materia Medica, Pharmacology and Histology. There are also at this booth many laboratory manuals. One of the books on exhibit—Potter's “Textbook of Zoology”—is printed on a green-tinted paper for the purpose of reducing eye strain. In addition to classroom text-books and laboratory manuals, there can also be found at the Mosby display many reference books covering a wide variety of subjects.

Leitz EXHIBIT

A Cordial Invitation
to Members and Friends

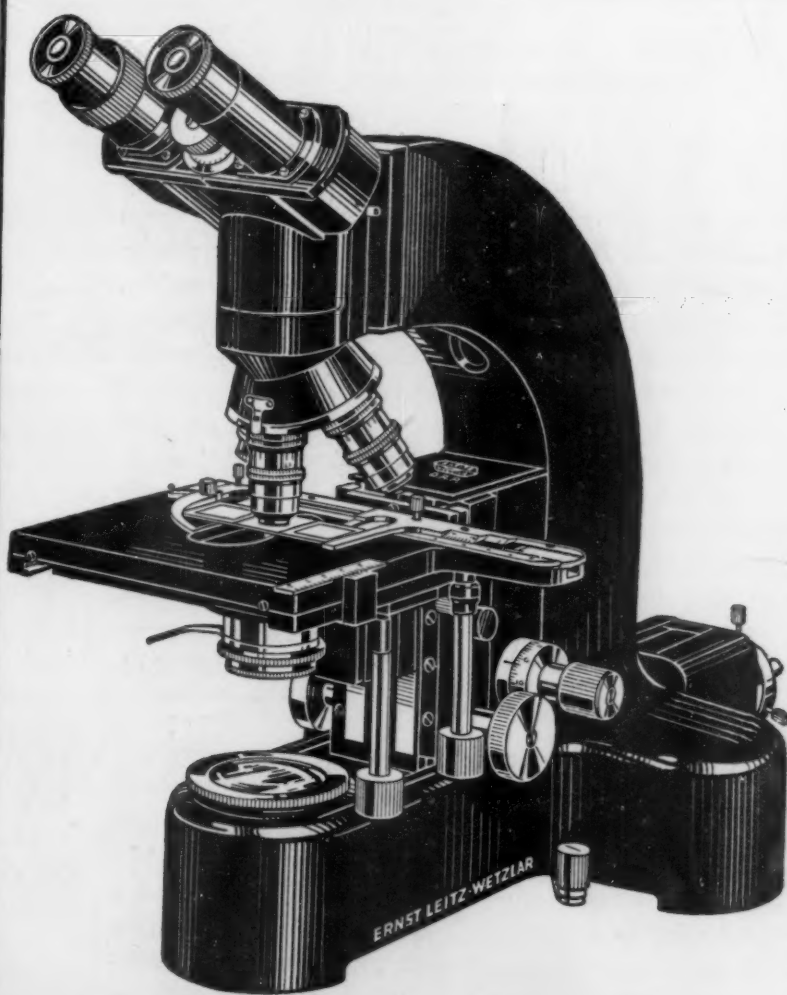
of the American Association for Advancement of Science

..... to visit our booth
(No. 9) at the Annual Meeting
at the Mosque in Richmond,
Va., from December 27th to 30th,
inclusive.

Among the instruments to
be exhibited we wish to
draw special attention to our
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MUSEUM OF SCIENCE AND INDUSTRY
New York

Booth Nos. 26, 27

This exhibition is a presentation of the New York Museum of Science and Industry. It aims primarily to indicate a few of the various methods employed in the museum for the display of exhibit materials of a scientific and industrial nature. Some of the techniques here shown were a gradual evolution derived primarily from past experiences, while others were developed after scientific study and observation to determine the special likes of the visitor. It is the aim of the museum in this exhibition to report briefly upon these practices with the hope that they may be helpful to those who are engaged in work of a similar character. Mr. Joseph Bracco, of the museum, will be present to explain the exhibits.

NATIONAL BROADCASTING COMPANY, INC.
New York

Booth Nos. 17, 18

The display of the National Broadcasting Company, Inc., at the meeting of the American Association for the Advancement of Science consists of a visualization of the services which radio is rendering the field of science and humanities; and will make available to those who visit the booth various pieces of literature which will explain the work which is being done in these fields.

NATIONAL BUREAU OF STANDARDS
U. S. Department of Commerce, Washington

Booth No. 39

The exhibit of the National Bureau of Standards will deal primarily with the work of the Bureau on building materials and problems relating to housing. The Bureau publishes the results of basic research on the properties and use of building materials in the interest of safety, durability and economy. It cooperates in the preparation of building and safety codes, assists in the development of specifications and gives advice on technical aspects of housing. A Geiger-Müller tube counter, with high-speed integrating circuit, designed to operate from an AC outlet, will be exhibited. This instrument will detect, by means of deflections of a millimeter, one millionth of a gram of radium at a distance of one meter. A chart, with samples of material, showing the separation of the lubricant fraction of petroleum into "homogeneous" fractions containing molecules of similar size and type. Dr. V. B. Phelan and Mr. G. H. Vaneman will be in attendance.

THE NATIONAL GEOGRAPHIC SOCIETY
Washington, D. C.

Booth Nos. 34, 35

The National Geographic Society will demonstrate how its unique wall maps are prepared. Photographs and a special display in charge of one of the society's cartographers show new and more efficient processes of map-making, developed in the society's cartographic laboratories. These new processes make the maps of the *National Geographic Magazine* not only timely and scientifically accurate, but also more easily read and handled, and give them greater reference value. Mr. E. John Long and Mr. F. B. Colton will represent the society.

PHIPPS AND BIRD, INC.
Richmond

Booth No. 14

Apparatus shown is mainly of interest to physiologists, pharmacologists and psychologists. For the first time a "continuous feed" kymograph is being shown. This, electrically driven and having eight speeds, obviates need for auxiliary drums and careful adjustment in the making of long paper records. Also on exhibit will be ink-writing levers, time-marking clocks, inductoriums, and a new pneumograph with much greater sensitivity than is possible with usual types. William Clift, Pat Gaskins, R. R. Chappell and A. B. Wigley will be in charge.

PRENTICE-HALL, INC.
New York

Booth No. 31

Prentice-Hall will exhibit their latest text-books in the fields of Physics, Chemistry, Mathematics, Engineering, Geography, Home Economics, Agriculture, Psychology; also such titles as: English in Business and Engineering, by Stevenson, Ames, Spicer and Kettering; Development of American Industries, by Glover and Cornell; Psychology in Modern Business, by Hepner; The Business Letter in Modern Form, by Butterfield; Report Writing, by Gaum and Graves; Napoleon: A Doctor's Biography, by Sokoloff, and Ascaris; The Biologist's Story of Life, by Goldschmidt. The text, Thermodynamics, by Enrico Fermi, winner of the 1938 Nobel Prize in Physics, will also be displayed.

RADIO CORPORATION OF AMERICA
New York

Booth Nos. 19, 20

The Radio Corporation of America will as usual exhibit the latest research advances made at their research laboratories.

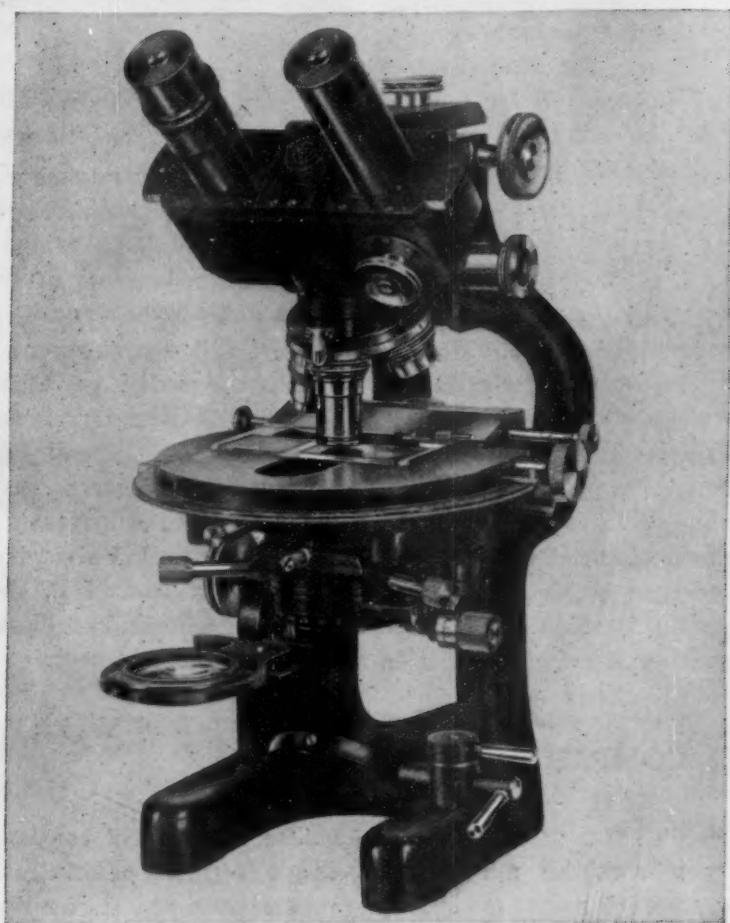
W. B. SAUNDERS COMPANY
Philadelphia—London

Booth No. 13

W. B. Saunders will exhibit their complete line of text-books and reference volumes dealing with the medical and biologic sciences. Of special interest will be the new text-book of "Biochemistry for Medical, Dental, and College Students," by Benjamin Harrow; also, Dr. R. C. Beck's "Laboratory Manual of Hematological Technique"; and a new book, "Pathological Technique," by Frank B. Mallory. There will also be new, revised editions of several standard works such as Jordan "General Bacteriology," Maximow "Histology," and Crandall "Elementary Physiology."

THE SCIENCE LIBRARY

The books of 1938 in the Science Library will reflect the scientific progress of the year. They are listed in the current issue of THE SCIENTIFIC MONTHLY, which will be distributed at the meeting. A reprint will be sent upon request.



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THE SCIENCE PRESS PRINTING COMPANY
Lancaster, Pa.

Booth No. 7

Publications printed by The Science Press Printing Company will be exhibited. Books and journals can be examined and orders placed. Blanks for inclusion of biographies in American Men of Science and Leaders in Education can be filled out. Advice will be given concerning the methods and costs of scientific printing.

SOIL CONSERVATION SERVICE
U. S. Department of Agriculture, Washington

Booth Nos. 15, 16

The Soil Conservation Service exhibit is titled, "Saving Our Soil." Six large photographic transparencies in the center background depict the successful erosion control practices of strip cropping, crop rotation, reforestation, terracing and vegetated waterways, revegetation of critical areas, meadow strips and contour furrows in pastures. Two side wings of the background pictorially present research data secured on experiment stations, which answer the question, "What happens when it rains?" Bert D. Robinson, of the Soil Conservation Service, will be in charge of the exhibit.

SPENCER LENS COMPANY
Buffalo

Booth Nos. 55, 56

The Spencer Lens Company will exhibit microscopes for high-school, laboratory or research work, as well as microscope accessories, microtomes, photomicrographic equipment and a complete line of Delineascopes for projecting opaque objects, lantern slides or film slides. New instruments will be exhibited, such as the Dark Field Microscope with permanently aligned illuminating equipment; the Quebec Colony Counter; the Spencer Spectrometer with camera spectroscope and other accessories for teaching; the new Model GK Auditorium Projector for color slides (convertible) 2" x 2" and 3 1/4" x 4", providing unusual screen brilliance and safety from heat; and the improved Spencer refractometer. Spencer laboratory and research microscopes will be featured as usual. F. J. Munoz, G. A. Grille, W. D. Mankin and A. W. Crawford will be present.

SUPERIOR TUBE COMPANY
Norristown, Pa.

Booth No. 25

This year the Superior Tube Company booth demonstrates the theme "Fine Small Tubing in Action." Everything on display will be a working model or a sample which can be handled and examined very carefully. A television tube and a complete selection of lockseam and seamless cathodes for radio tubes will be shown. Get your sample box of cathode sleeves from our representatives. The model drawbench will actually cold-draw tubes from .156" O.D. down to .125" O.D. The efficient bright-annealing furnace will also be in operation. Superior Tubing is used extensively in a number of fields, including radio (both production and experimental), general lab-

oratory and scientific instruments, aviation, and innumerable medical and dental uses. Many industrial applications will be on display. Our representatives will be Mr. Henry B. Brown, Jr., and Mr. Ardrey M. Bounds.

UNIVERSITY PRESSES
A Cooperative Exhibit

Booth No. 23

The University Presses will again have a combined display of their new publications in physical and biological science in Booth 23 of the Science Exhibit. There will be scholarly journals of professional interest, reference works and text-books at the college level. The following presses will be represented: University of California Press, University of Chicago Press, Collegiate Press, Columbia University Press, Cornell University Press, Duke University Press, Harvard University Press, University of Minnesota Press, University of Oklahoma Press, Oxford University Press, Princeton University Press, Stanford University Press and Yale University Press. Mr. Donald P. Bean, Manager, The University of Chicago Press, and Miss Janet Marshall, of Yale University Press, will be in charge.

JOHN WILEY AND SONS, INC.
New York

Booth No. 10

The display will consist of the recent books published in all the fields of science and technology covered by the publications of the company. May we suggest that particular attention be given to the following important new books: Blackwood, "Introductory College Physics"; Clark, "Photography by Infrared"; Glockler-Lind, "Electrochemistry of Gases and Other Dielectrics"; Clements-Shelford, "Bio-ecology"; Goulden, "Methods of Statistical Analysis"; Rider, "An Introduction to Modern Statistical Methods."

THE WILLIAMS AND WILKINS COMPANY
Baltimore

Booth No. 30

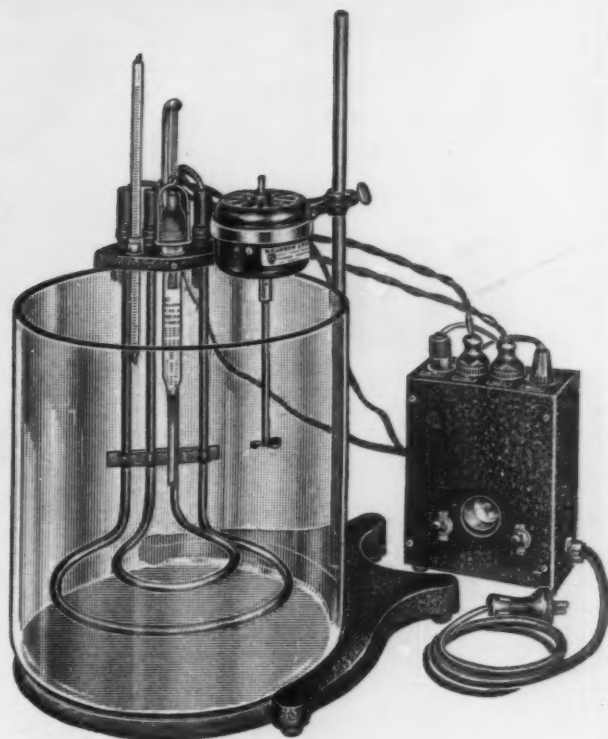
The Williams and Wilkins Co., of Baltimore, will exhibit their most recent books, as well as their whole group of scientific periodicals. Among the new books shown will be the \$1,000.00 Prize Manuscript Contest winner, "Biography of the Unborn," and Dr. Robert Hegner's "Big Fleas Have Little Fleas," the manuscript for which was submitted in the contest.

DR. LOUIS B. WILSON
The Mayo Foundation, University of Minnesota

Booth No. 40

A method of mounting and projecting 35- and 16-mm film pictures in glass slides without masking in the slide. Each slide may contain any number of pictures from one to twenty. Slides all pass in same direction through adapter. They are held in exact focus, therein. The adapter provides "masking" effect. It may be easily constructed to fit any large projector. Dr. Wilson will be present.

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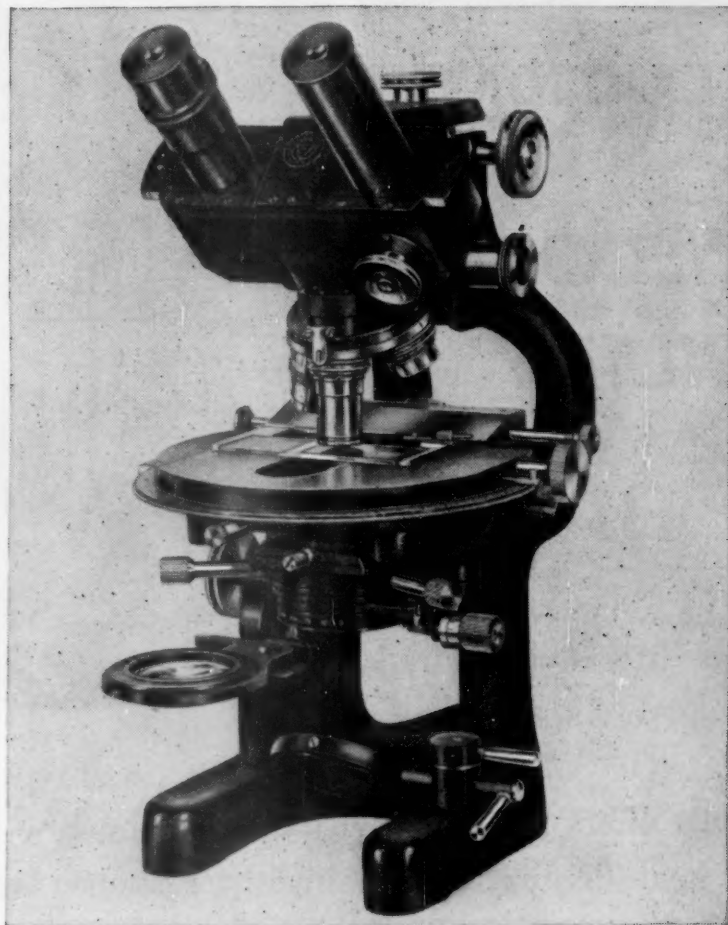
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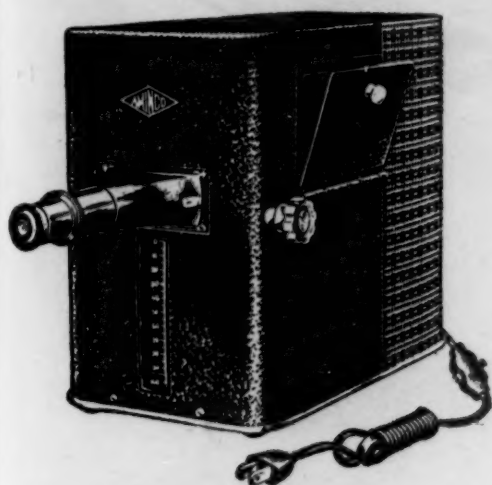
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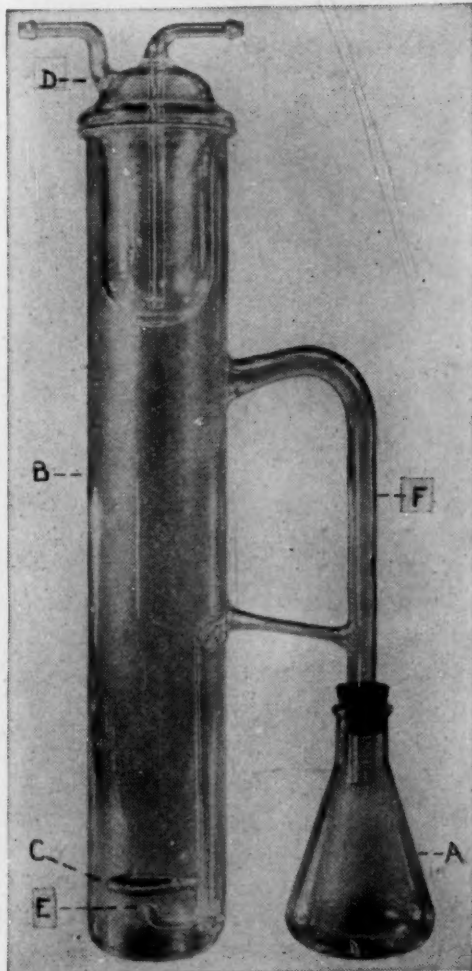
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